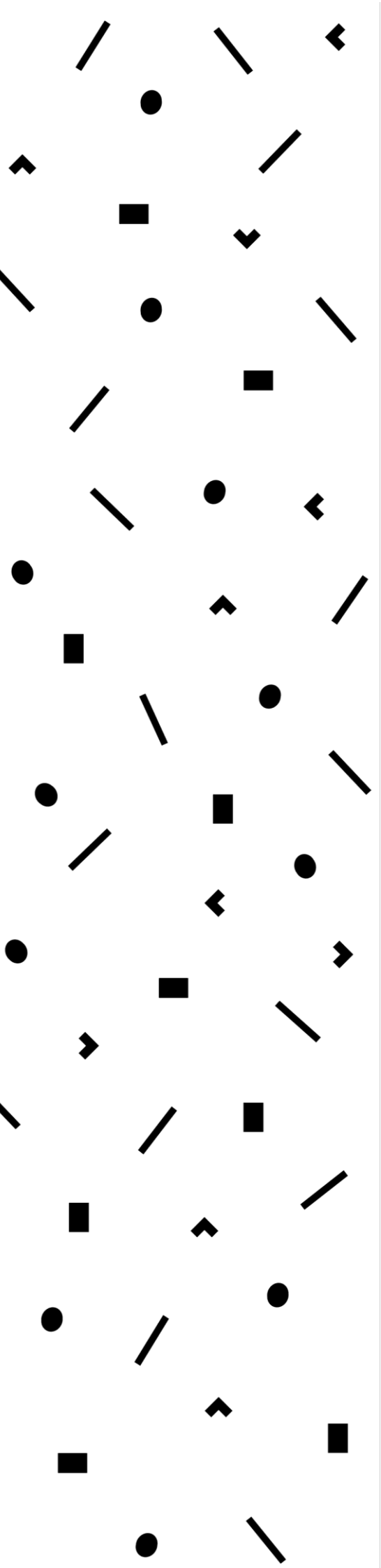

LAMK Lahden ammattikorkeakoulu
Lahti University of Applied Sciences

The future of responsible investments in the context of algorithm-based decisions

LAHTI UNIVERSITY OF APPLIED SCIENCES
Faculty of Hospitality and Business
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KARELBERG, MARJUT: Vastuullisen sijoittamisen tulevaisuus algoritmipohjaisissa päätöksissä

78 sivua, 1 liitesivu

Kevät 2018

TIIVISTELMÄ

Tulevaisuuden investointipäätöksenteko muuttuu organisaatioiden vastuullisuusvaatimusten lisääntyessä. Tekoälyn algoritmien kehittyessä organisaatiot joutuvat yhä enemmän arvioimaan toimintansa vastuullisuuden painopisteitä, ja sitä, kuinka paljon tekoälylle annetaan toimintavaltaa. On kannattavaa huolehtia investointituotteen brändin arvosta ja valmistautua tuleviin lainsäädännöllisiin vaatimuksiin.

Kokonaisvaltainen organisaatioiden vastuullisuus, joka huomioi ympäristöön liittyvän, sosiaalisen ja hallintoon liittyvän vastuullisuuden, on kilpailutekijä, jonka sisäistäminen vaatii eettisyyden tajuamista, mitä tekoälyllä ei toistaiseksi ole. Kilpailutekijänä vastuullisuus on aineetonta pääomaa - tulevaisuudessa sijoituspäätöksiltä edellytetään vastuullista imagoa, koska kaikkeen ihmisen toimintaan vaikuttaa ilmastonmuutos, nyt ja tulevaisuudeessa vielä enemmän. Sijoittamista koskevassa päätöksenteossa on oleellisena osana tekoäly, jonka kehittäjillä on paljon valtaa sijoittamisvalintoihin.

Tutkimuksen tavoitteena on selvittää, voiko tekoäly oppia seulomaan suuria tietomassoja (Big Data) niin, että sijoituspäätökset ovat kestävän kehityksen mukaisia ja vastuullisia. Tutkimuskysymyksen tavoite on asiantuntijahaastatteluin selvittää, voiko vastuu olla tärkein kilpailutekijä tulevaisuuden investointipäätöksissä, jotka perustuvat algoritmien käsittelemään tietoon.

Tämä tulevaisuuteen suuntaava tutkimus osoittaa, että etiikka ja ympäristöasiat tulisi huomioida sijoituspäätöksissä. Investoinnit vaikuttavat koko yhteisöön, samalla kun maailma tukeutuu yhä enemmän digitalisaatioon ja tekoälyyn. Tällä hetkellä asiantuntijoillakaan ei ole yhtenäistä, tarkkaa näkemystä tai varmuutta tulevaisuuden sijoituspäätösten vastuullisuuden kehityksestä. Jos valta on ohjelmistokehittäjillä, jotka rakentavat ihmisten ja koneiden yhteistä älyä hyödyntäviä palveluita ja sovelluksia yrityksille sekä valtioille, heillä tulee olla vastuu.

Avainsanat: sijoittamisen vastuullisuus, tekoäly, algoritmi, vastuullinen pääoma, vastuullinen imago, sijoittaminen, arvot.

Lahti University of Applied Sciences
Master's Degree Programme in International Business Development

KARELBERG, MARJUT:

The Future of Responsible Investments in the Context of Algorithm-Based Decisions

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ABSTRACT

An investor may have different and often parallel causes to invest responsibly. The motives for responsible investments are often linked to wider risk management and ensuring good investment returns. In addition, the investor can apply for social acceptance for his / her own actions by noticing ESG matters. It's profitable to take care of the brand value of the investment product, as well as prepare for future legislation demands.

The main research question is figuring out, whether the artificial intelligence (AI) can learn to sift the Big Data, so that responsible decisions can be done reliably. The survey of this qualitative reseach is implicated by interviewing highly qualified experts from investing, algorithm programming and climate research industries.

The theoretical part of this research focuses on mapping out future visions and it aims to illuminate the dimensions and goals of responsible investments as the world is increasingly relying on digitally assisted decision-making.

Based on the results, there is no consistent, accurate view or certainty of the future development of responsible investment decisions. According to the results, artificial intelligence is constantly being developed so that it learns to learn, and its use increases in the analysis of investment information. In the future - in the era of Big Data and AI - services and decisions are based on the common intelligence of humans and machines, and software developers will build intelligence-based services for both domestic and international companies and states.

Key words: responsible investment, investments, artificial intelligence, algorithm, digital technology development, responsible capital, responsible image, ethical values.

ABBREVIATIONS

AI	Artificial Intelligence
API	Application Program Interface (sovelluksen rajapinta)
AuM	Assets under Management
CDP	Carbon Disclosure Project
CPU	Core Processing Unit
CVLF	Climate Viability Length Forecast
ESG	Environmental, social & governance (issues in financing)
ETF	Exchange-Trated Fund
FINCIF	Finland's Sustainable Investment Forum
HOAS	Helsingin Opiskelija-Asunto Säätiö
MiFID II	Investment Service Directive
ML	Machine Learning
NBF	Nordic Business Forum
PE House	Private Equity House (pääomasijoitusyhtiö, in Finnish)
PRI	Principles for Responsible Investment
PSD2	Revised Payment Service Directive
PwC	Price Waterhouse Coopers
ROI	Return on Investment
RPA	Robotic Process Automation
SGPAID	Strategic Groups Participating Artificial Investor Developing
UN	United Nations
WBCSD	World Business Council for Sustainable Development

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1 INTRODUCTION

Responsibility should be a viable investment strategy also in the future. Basically, investors are supposed to be human beings – robots do much more than just the physical or monotone work. Ordinary robots do what they are told to do, but robots – and algorithms - may also be programmed to make decisions – that may be the future of artificial intelligence. I do not argue that robots make future investment decisions. I connect artificial intelligence in this study, because investing is a future-oriented activity, and AI seems to affect to our future and help decision-making.

Artificial intelligence has its own will if we let it have. What should artificial intelligence know and what kind of experiences humans should load into it, to make it understand what is important for humans to survive and live a life worth living, also in the future, if the climate change and social inequality develops in the unwanted direction? In this study I presume the investor is a human, with algorithm that learns to think like a human. In the future human knowledge, societies, thoughts and digitalization developes so fast, that what we think today about the future, may be nearer than we can imagine. We can also be totally wrong; the future may be very different than we thought it to be in the light of current knowledge.

Investments are always directed towards the future. Can AI integrate responsibility into the investment products profitably? The focus of this research is, how much significance has the responsible image for strategic planning of investments, when data is handled by artificial intelligence? We don’t know, whether AI can be taught to learn issues of responsibility.

The research considers triple bottom line, which is a measure of sustainability that includes financial, social and environmental performance measures. That applies to all investing - share investments and institutional investments. To increase responsible thinking in investment products' marketing, marketing communications should strongly emphasize the responsible side of the investment products and bring out, that ESG issues (Environmental, Social and Governance issues in

financing) are actively considered. Responsibility should be connected to big data, in such form, that AI can utilize it. One starting point for this research was my participation in the Nordic Business Forum (NBF) and writing an essay of it. Endless economic growth requires money to generate more money. There is no place for life that can not be converted into money. Debt demands growth, and when money is created from debt, it is created on condition that the debtor will pay more money to his creditor in the future, as interest rates. The effects of endless economic growth on planet have been like the impact of cancer in a human body.

This thesis is seeking a response for the question about future investments: could responsible investments be enhanced reliably by AI and machine learning by developing AI into direction, that utilizes ESG for making investment decisions. Could responsibility be the major competitive factor in future investment decision-making, that will base on information processed by algorithms? Responsibility is more than ethics, responsible investment activity means taking full account of sustainable development in the allocation of money. It involves ecological, social and administrative accountability - understanding of them requires the ability to ethical thinking.

The results of responsible investments can be measured by long-term studies of community and climate wellbeing. This thesis focuses on measuring the theoretical question, that would it be possible at all, that AI could have and take the power of investment decisions. Like all investments, responsible investments have risks and opportunities. By drawing on previous studies and this research work, I'm trying to learn, what limitations there are, in general, that prevents investors to use triple bottom line thinking in their investment decisions.

2 OBJECTIVES AND METHODS

The main objective is to find definitions for different terms and operators related to responsible investments, so that it is easier to talk about these issues in different contexts now and in the future. Whether the ESG can be respected enough (by investors & AI developers & governments & legislations) to drive investment decisions in the future, while AI processes all the Big Data information, that investors use in making decisions, is one issue in this research. The main research question is built to find out, if AI can learn to sift the big data so, that responsible decisions can be done reliably.

This study of future shows that it is necessary to account the results of the environmental research as well as to really modify the practices. The change in the way of action also applies to consumers, not just investors. Investments affect the whole community, they are not just private procurements, even though the shareholder is a person or a private company, instead of faceless community or artificial intelligence. This study seeks to examine, what the algorithm-based information could give for investors who try to make responsible investments, and further make recommendations to awake awareness of investors and decision-makers to see, what kind of possibilities and risks AI can cause to their work especially in future.

The study reaches to the future, because investments are directed towards the future, and because the digital algorithms are developed so fast, that what is relevant today, quite surely is old-fashioned and irrelevant already in a year or two. After 10 years the situation has changed so remarkably, that even experts are confused about the future results of the development of AI. The issue here is, how does AI correlate with the deep responsibility of investments, that can save or destroy our future, because all investments affect our society in the big picture that appreciates sustainable environmental, social and good governance.

Another objective for this study is to enable decision-makers (=investors) - whether it is humans or artificial intelligence - who have the access to assets and its dominance, to open their eyes and lighten the sight of future. This study has extended my own views concerning money circulation and its impact on our environment. I aim to produce a synthesis; a combination in which tho wholenesses generates more than just the sum of its parts (emergence). My intention is to raise the need for further examine into environmental and ethical investments, by showing what is the value and power of responsible capital. This study raises the issue of the development of a friendly, comprehensively thinking AI, because the decisions made by the AI is becoming more common.

2.1 Research questions

The main question:

Could responsibility be the major competitive factor in future investment decision-making, that will base on information processed by algorithms?

The sub-questions:

Who or what may decide, what are the future investment targets and based on which information, the future investment decisions will be made?

If AI can seek for, perceive and sift responsible investments from all investment targets and offers – can it also understand the value of findings and utilize that information correctly?

Could responsible investors get more reliable information of investment targets, with the help of artificial intelligence?

2.2 The method and the approach in research

Scientific research consists of problem layout, research strategy, data acquisition method and data analysis method. Scientific data acquisition is part of the process of data selection - it is important to use the alternative

search methods provided by databases (quick search, extended search, search on a freely chosen search term, keyword search) and search tooling (search result sorting and analysis). Choosing and observing the method of doing research is a key part of the research process. The selection of the method of research also affects other areas of research. The method involves selecting and observing both the research strategy, the material acquisition method and the analytical method. In a qualitative study like this, the themeing method can parse information into a clear format that brings out the most important information in a document. The problem layout of this research is to describe connections between phenomena. Describing connections does not aim to make a clear-cut analysis of the cause-effect relationship. In this study, the relationship between phenomena are viewed in a qualitative way, where the significance of the phenomena is examined, and there are several connections between the phenomenas.

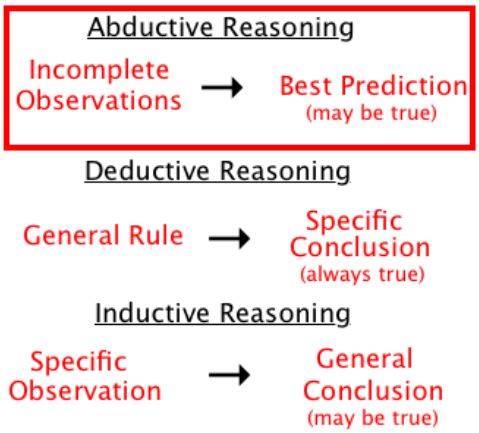

FIGURE 1. The main differences between abductive, deductive and inductive reasoning (Research-methodology 2018.)

Reasoning - the approach in academic research - is a process that uses existing information to draw conclusions, create predictions, or make explanations. There are three ways of reasoning: deductive, inductive and abductive approaches (picture 1). The theoretical approach to the research material can be referred as an abductive reasoning (Tuomi & Sarajärvi 2002, 99). The formation of a new theory is possible when

observation is associated with a guiding principle. Abductive reasoning, that often begins with an incomplete set of observations and proceeds to the likeliest possible explanation. (Butte 2016.)

According to Saaranen-Kauppinen & Puusniekka (2006), the abductive analysis means, that between theory-based and material-based research, there is a theoric-bound research, where the analysis of the material is not directly based on theory but the connections to it are noticeable. When induction starts from empirium, and deduction starts from theory, abductive analysis often starts from empirium but does not reject the existence of theory as a background information. To draw the theoretical background can be done by literature and previous theories, not necessarily as such, but as a source of action plans and ideas. I chose abductive reasoning for this thesis, because it allows the observations to focus on some of the factors or circumstances that are believed to produce new perspectives and ideas. A new theory does not arise solely on the basis of observations, as assumed in inductive reasoning, but through the guiding idea. The guiding principle can be an intuitive idea or a progressively formulated hypothesis, which even can be changed or canceled during the process. With abductive reasoning, the observations can be concentrated on some aspects or conditions that are believed to produce new insights and ideas, new theory or new modeling of that phenomenon. The idea of abductive reasoning is that the researcher's interest is targeted at certain, important, supposed or known issues. It is possible for a scientist to get into traces of a new theory, without knowing it beforehand (Bergman & Paavola 2014.)

“For Charles Peirce, who coined the term ‘abduction’ a century ago, the introduction of unifying conceptions was an important part of abduction, and it would be unfortunate if our understanding of abduction were limited to more mundane cases where hypotheses are simply assembled” (Thagard & Shelley 1997).

2.3 Document structure

The document structure consists of five titles: 1. Introduction, 2. Objectives and methods, 3. Responsible capital meets future algorithms, 4. Research process: data collection and analysis, and 5. Conclusions and recommendations. The theoretical basis, i.e. definition of responsibility in future investments, in chapter 3, begins by figuring what are the different areas of

- investments and responsibility (3.1)
- the features of the artificial intelligence (3.2)
- the conclusions of theoretical framework (3.3)

The basis for this research includes determining investing, and what investing is not, or the opposite of investing. I study investment and responsibility of environment as terms, and as a phenomenon: with related values, visions, cultures and ethics, because they cause local variations. This study includes also what investing and responsibility has meant, what is it now, and especially what is it going to be in the future, during the effects of digitalization.

The introduction describes the background. The second chapter explains the research bases, goal and purpose of the research, as well as introduces research questions. Chapter three (the theoretical basis) clarifies the theoretical framework and the concept analysis. I look at the relationship of the ESG approach to investment activity and define the related terminology. Chapter 3 describes how can the investments act as an opportunity to sustainable influence.

In chapter four I present the progress of the work and the methods and implementation and the description of data. At the end of this chapter, the findings of the study are being reported. In the fifth chapter I answer to the research questions and draw conclusions, with assessment of the research and evaluations of further research and development opportunities. The recommendations are presented in this chapter.

Only a low percentage of population make huge investment decisions that affect our environment safety, but a clean and safe habitat and a fuctioning ecosystem mean the safety of every human being. Algorithms don’t have the same needs as humans. As artificial intelligence is a technological creature, there are challenges to create such an intelligence that pays attention to human needs. Climate issues and environmental responsibility are prominent in the media, but people have a rather fragmented understanding of the importance of the topic. We should think about the meaningfulness of investments, also the smallest ones.

The significance of the study is, that like the butterfly effect (sensitive dependency on initial conditions), even a small investment affects the whole world’s living populations, in unpredictable ways – investments mean making decisions. Small inaccuracy in initial values can generate chain reactions that change the final result in the long run to a completely different one (Lorenz 1961, as cited in Dizikes 2011). Are decision-makers as aware, as they possible can, about the impact of their decisions on our living environment? Clean energy investments are welcome, provided that the environmental effects would be known. No one knows exactly, how and where all the investments affect in global scale.

3 RESPONSIBLE CAPITAL MEETS FUTURE ALGORITHMS

3.1 Investments and responsibility definitions

Investments (made by private people or organizations, or institutions) usually have a long-term expectation period (before it gives revenue) – that is why we can call investors as visionaries. Visionaries look for the future that provides a viable operating environment, that is not destroyed by pollution or any destructive factor. To know, what might investors be looking for now and, in the future, what kind of investment activity can achieve sustainable development, and what can be done with responsible investment, we need to know the **definition of responsible investment:**

According to Finsif (2018), responsible investment means involving ESG matters (Environment, Social and Governance) in investment activities to improve the portfolio's return and risk profile. There is no one or only way of responsible investment. Each investor chooses tools appropriate to his own investment strategy. An investor can use ESG matters from different approaches. Responsible investment concerns all asset types. (Finsif is an abbreviation of "Finland's Sustainable Investment Forum", that is a network for Finnish investors promoting responsible investing.)

Can responsible investment be a threat to the environment or to investor's assets and is it ultimately tied to our values? To put a price on value, requires knowledge. Investor thinks, what is worth investing money. Responsible thinking means different values for individuals and for organizations. Especially multinational global companies and corporates responsibility has become both an everyday act and a dimension of competition and renewal. Some business educators and developers think that the best drug to the problem of corporate responsibility is to make it a competitive advantage for companies, this is so called win-win thinking, which is quite tempting way to bring responsible ideas to business core. This was a mainstream concept already in 2011. There have been three main reasons to emphasize corporate society responsibility:

- globalization: developed countries did not work ethically in developing countries and developing countries did not receive a fair price for the food and raw materials they produced
- financial problems of welfare state, which led to the desire that companies and individuals would voluntarily carry more responsibility for the various services
- companies have constantly broken the insider rules of the stock exchange, competition law and accounting law (Halme & Lovio 2004.)

Peaceful management of the environmental challenges is possible only in countries where the political system is sufficiently widely used to meet people's needs. We need to adopt the circular economy, or rather the spiral economy: the material (substance), energy and human capital must be circulated. As before, all human and natural activities must be understood as streams and systems, not as individual phenomena with tight bounds (Wilenius 2016).

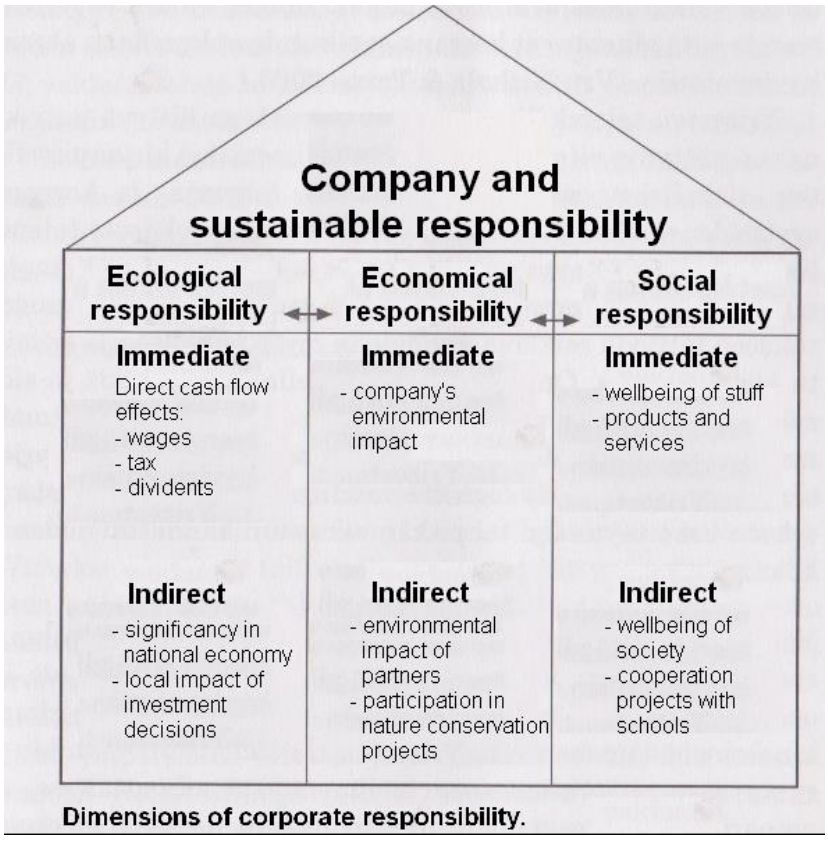

FIGURE 2. Dimensions of corporate responsibility (Rohweder 2004, 97.)

Wider concept of responsibility of companies means much more than just ecological thinking or ecological responsibility (see figure 2). The tripartite of responsibility is actually *triple bottom line* -thinking, which means that all areas (ecological economical and social) must be in balance (Joutsenvirta et al 2011, 13). The leadership that considers threats and challenges as well as possibilities of sustainable development, gives a positive signal for investor who is looking for safe and long-term investment targets (Kuvaja 2010, 153).

In general, responsible investment means environmental issues, social responsibility factors and governance issues. Considering ESG (Environment, Social and Governance) in investment activities, means improving the portfolio's return and risk profile. There isn’t only one way of responsible investment - each investor chooses tools appropriate to his own investment strategy.

An investor can take ESG matters into investment by relying on different approaches. Responsible investment can be made in all asset types (Finsif 2017). According to Finsif, in ESG aspects E means:

- standards and certificates
- environment programs
- climate change research & work
- energy efficiency
- biodiversity
- circular economy

According to Finsif, S means:

- HR policy
- human rights
- children rights
- labor rights and legislation
- product responsibility
- local community consideration

According to Finsif, G means:

- independence of government / Board of Directors
- rewarding the Board
- managing director and managing team rewards
- reward systems
- taxes
- anti-corruption activities

3.1.1 Ethics and current financial sector

Fund analyst, journalist Matias Möttölä mentions: “the financial sector needs ethical aspect – scandals destroy the reliability fast”. (Möttölä 2017.) Helsingin Sanomat recently told about a 77-year-old widow who had been attracted by a bank to make fools investments. The unlucky and unexperienced customer had not realized that the stock trading recommended by the bank would cause a huge tax bill. Arvopaperilautakunta (2017) has determined to pay the bank compensation. The Financial Supervisory Authority (Finanssivalvonta, 2017) warned and gave a fine for four companies that had poorly organized the advising service for elder customers. The largest - million-euro payment - was received by Nordea, whose customer the 77-year-old widow was.

According to Mo Gawdat (Kauppalehti 2018), many companies are already interested in doing good. Wise business leaders understand that resolving the major problems, such as climate change, is also a good business (Kauppalehti 2018). The negative publicity concentrates mostly for a small group at financing sector’s operators, but stories are true.

The positive contribution made to the financial sector in the prosperity of societies is undeniable, but it has left unnoticed. Broker’s assignment is to be reliable. If trust disappears, the entire financial sector is in trouble, even if it continues to make a profit. According to CFA Institute, (2017), only

11% of financial managers believed, that their work is socially significant. The mission of financial sector is to channel wealth from savers to investors. Only few people can buy a house or apartment without a bank loan, which, the bank finances with deposits. Without financiers the growth of companies would be much slower, and pensions would be much smaller without profits from investments.

3.1.2 Ethical investments and related values

As we talk about ethical values and responsibility, most likely we say something about cultures and visions, too. Instead of responsible investing, Sari Kuvaja (2010) writes about ethical money, and “good money”. Ethical investment’s culture has become more common in Finland in the 21th century (Kuvaja 2010). Value-based trading and investing has hundreds of years of history. In 1600’s, George Fox established the Religious Society of Friends, commonly known as the Quakers, or Friends (kveekarit, in Finnish). They refused to have business with partners who are involved with warfare and weapons, or who took advantage of inequalities between people – it’s not acceptable to benefit for other’s distress.

The way the Quakers used to avoid dubious partners could be called a strategy that excludes certain criterias, or “exclusionary criteria -strategy”. Moved to investment, this idea could be called a negative valuation. Exclusion of certain industries and businesses is still one of the approaches of ethical or responsible investment, but it was still the only approach in the 1990’s. Today we speak about “responsible investment” and “funds financed by accountability”. An ethical investor means a private investor who makes investment decisions based on his /her personal values. Ethical investment means value-based investment. First ethical fund in Europe - Aktie Answar Myrberg – was established in Sweden in 1965. Pax World Fund was established in USA in 1971. (Kuvaja 2010.)

In 1990’s it was typical to think that a company that invest to environmental sustainability more than the law requires, cannot achieve a

viable financial result and it will endanger its financial success. Luckily, nowadays thinking has developed. Because ethical investment has become more common, there has begun to accumulate real information about it and its economic productivity. According to that, many researchers and financial professionals have made the conclusion that an investor using accountability criteria does not have to compromise on earnings (Kuvaja 2010).

Problems with responsible business are becoming more complex in the international world (Joutsenvirta, Halme, Jalas & Mäkinen 2011). The roles of different actors in society shape the attitude – market players, the public sector and the third sector, which is a voluntary sector i.e. organizations such as various registered societies (Kolmas sektori). In corporates and in business education, responsibility has typically been viewed from the perspective of economic profitability. Corporate responsibility can not be viewed separately from other mechanisms of social responsibility. During the reign of globalization, we are not anymore living in a regulatory society – therefore, companies must consider the political and social consequencies and impacts of their controversial actions. The debate on corporates' social responsibility has two sides. In leaders' speeches and business advertisements, responsibility seems to be well handled. Companies want to show how they are concerned about people and nature. On the other hand, often the subject is discussed in blatant and ever bitter tones: more responsibility is required from companies, for example when factories are closed, ethically dubious production methods are used, taxes are circumvented, or human rights are offences. Who might know, which opinion is more truthful now and, in the future (Joutsenvirta et al 2011).

Ethical investment was fashionable in the 1990's. At that time Sweden and the Netherlands were pioneers of ethical investment. Swedes excluded from the investment portfolio wines and tobacco. The Dutch people liked to drink liquor, but nuclear power was unethical. The world was both easy and difficult when ethics was implemented by excluding the unethical investment targets of your own morality. "It was ethical enough to remove

unethical investment objects that were not in accordance with their own morals.” The theme has since become more diverse. Instead of ethical investment, we talk about responsible investment and ESG, where E refers to the environment, S to the social responsibility and G to the good governance. Investment targets are no longer excluded, or, in the event of a problem, they are urgently needed to sell out, rather than wanting to influence companies to improve their business. (Hokka 2016.)

Measuring responsibility is difficult. Some investors are well versed in ESG's opportunities and problem areas. For those who do not have their own analysis, there are different ESG scores and ratings. They should know exactly what method of analysis has been used and what kind of scoring elements are produced - the same company can get a completely different assessment of their actions from different runners. When these one-company scorings are combined with the coporates and whole investment fund scorings, we see a big "black box". ESG has become a big business - to get more accurate ratings, you need to buy that service. Companies have increasingly begun to include ESG issues in their reporting. Propably, this will be more common, and all investors will be able to assess the concrete nature of responsibility and see, how **ESG can be related to corporate strategy.** (Hokka 2016.)

Many asset managers integrate ESG into their own investment processes and make analyzes easier if companies begin reporting more. “Greenwash” and simply building a picture without concrete is no longer enough. Especially from the view of a small investor, it seems almost unethical that all the other financial information is available for free, but, to get reliable ESG information, they must pay. (Hokka 2016.)

Some of the investors consider sustainable development as an avocation, but it is ultimately what society is going to cope with. At least not with tax evasion or by worsening working conditions. (Elo 2017.)

3.1.3 Prosperity without growth

Mr. Tim Jackson (Joutsenvirta et al 2011), a researcher on sustainable development, reported about decrease in growth, in “Prosperity Without Growth” to British Government in 2009. He wrote that first there must be limits on the use of resources and environmental damage by

- limiting use of resources and climate emissions
- setting tangible targets to reduce production
- changes in taxation and business support systems
- supporting environmental goals of developing countries

Secondly, economic models need to be corrected. That means the use of ecological macroeconomics, which means that investments are targeted to work, capitals and infrastructure. It also means curbing the financial markets and careful investment activities. (Joutsenvirta et al 2011.)

Third goal according to Jackson is to change the social sence that makes a circle (treadmill) of working and consuming. Concept of work should be renewed by sharing jobs for many people and checking the concept of working time: that supports community cohesion. (Joutsenvirta et al 2011.)

The amount of profit tax can be adjusted by legislative action. Companies could be obligated by the law to emphasize socially valuable goals in their articles of association, and to limit the pursuit of monetary gain. It is also possible to reward limited liability companies, for example with tax breaks. Some companies have introduced the principles of good corporate governance. Good governance can alleviate the disadvantages caused by companies' actions to the environment and society. However, good governance is often carried out in such a way as to protect the rights of the owners, and the interests of the owners are more important to the interests and objectives of other stakeholders. Increasing number of people in Western industrialized countries have begun to have more free time in their lives. Nevertheless, business and limited liability companies can still be an important part of society, if they are able to adapt and support the values and goals of fiscal prosperity rather than profit and growth. We talk

about social enterprises whose idea is to benefit society and the environment (Joutsenvirta et al 2011, 352-354).

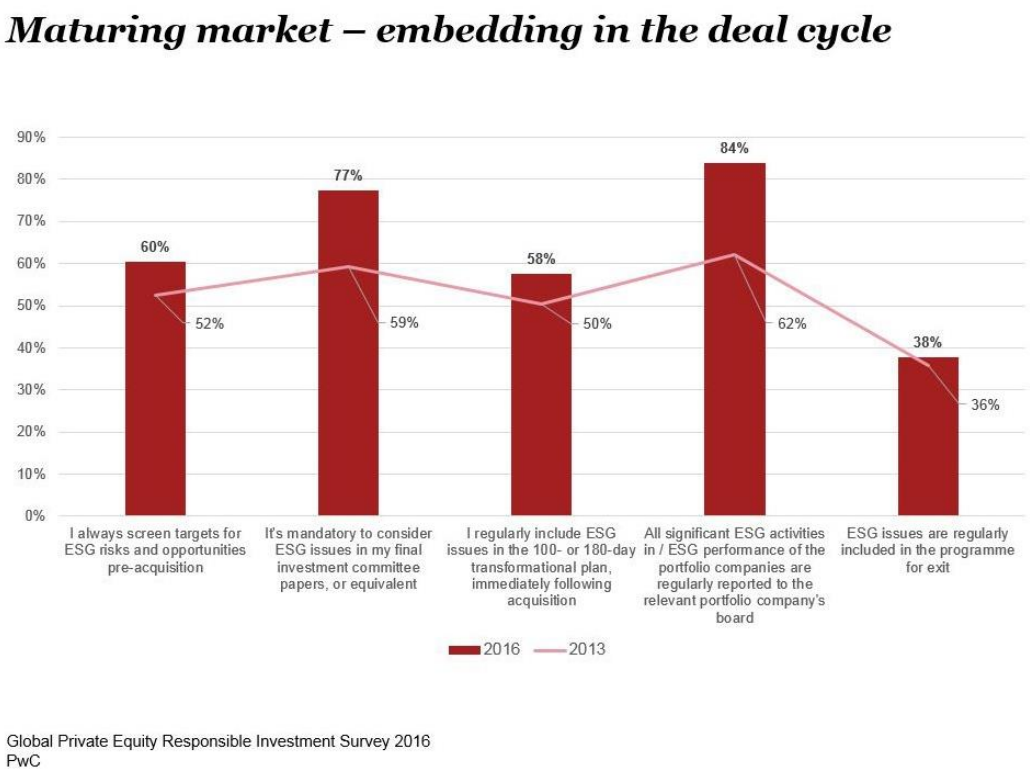

FIGURE 3. A research made by PwC (Juutinen 2017.)

According to Juutinen (2017), there are five main results in this research (the survey was first made for 2013 and again for 2017):

- 2/3 of investors assess the ESG-risks and opportunities while considering the appropriate companies in their portfolio. In 2013 half of respondents did that.
- ¾ told that today they insist from decision-makers in councils to regard ESG in investment decisions
- more than half told that they take into consideration in their 100 or 180 day plans the ESG to ensure right kind of development immediately after the aqcuisition.
- the most significant ESG aspects that exists in companies in portfolio, were reported to their board by 84% of respondents. In

2013, the figure was 62%. So, awereness of responsibility has been increasing.

- one thing has not changed from 2013: in exit program (“the detachment phase”) ESG aspects have not been noticed increasingly

3.1.4 Responsible investment – a chance for the future

Responsibility does not mean that responsible investment actions would change the world immediately. Comparing to ethical investment, responsible investment has a different yield concept, as figure 4 illustrates (Hyrske et al 2012).

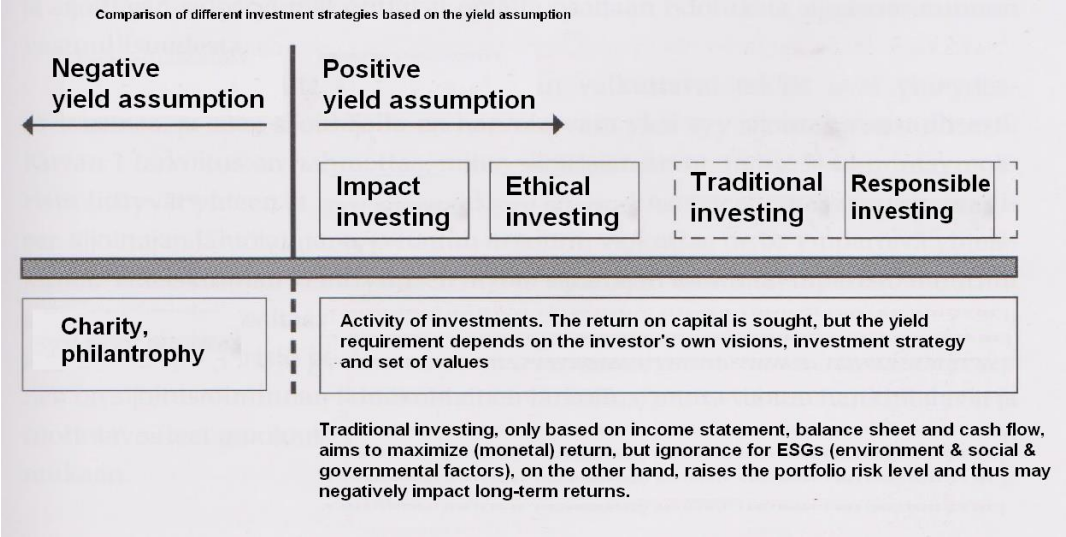

FIGURE 4. Comparison of different investment strategies based on the yield assumption (Hyrske et al 2012.)

Corporate responsibility is best when creating good practices and making decisions to improve the world. At its worst, the discussion about responsibility only misleads the extent to which basic changes in business practices would be needed to save well-being. Making promises in the name of responsibility does not mean that action would change the world. Investment is a good example of this. While striving to integrate ethical principles, it is not easy to promote justice by investing. The first difficulty is the narrow field of action. The direction of society's development, based

entirely on money, depends on decisions, who gets funding, for what purpose, how much and under what conditions. These decisions are mainly made in banks, and these decisions have a far greater significance for the development of society than taxation or government reform (Iivarinen 2015, 196).

Responsible investment could change investor's world in many levels. According to PwC Global PE Responsible Investment Survey 2016, any business faces the challenge of identifying risks at speed to remove or reduce their impact on the bottom line. PE Houses - Private Equity Houses [pääomasijoitusyhtiö in Finnish] - are no exception, companies must have insight across a broader range of factors. Cyber security is top of their risk agenda followed by human rights and climate change risks. Recognition of risks is higher than action to mitigate them. Less than half of respondents have plans in place to reduce their risk exposure. "PE houses are horizon scanning and there is strong awareness of what's on the government agenda too. Many [companies] have already started to consider how the sustainable development goals (the UN goals tackling 17 major world issues agreed by 193 governments) will impact them with 44% planning to assess their impact and 36% recognising there is reputational benefit in supporting them." (PwC 2017.)

PwC is putting a price on value. PwC's PE responsible investment survey shows more opportunity for value protection and creation through Environmental, Social and Governmental (ESG) management. Any business faces the challenge of identifying risks at speed to remove or reduce their impact on the bottom line. PE houses are no exception. Buying, selling and investing in companies means they must have insight across a broader range of factors. There's a need to understand the risks that impact upon not only their direct business and market, but also those of their individual portfolio companies. Cyber security is top of their risk agenda closely followed by human rights and climate risks. Surprisingly, recognition of risk is far higher than action to mitigate them – less than half have plans to place the reduce their risk exposure. (PwC 2017.)

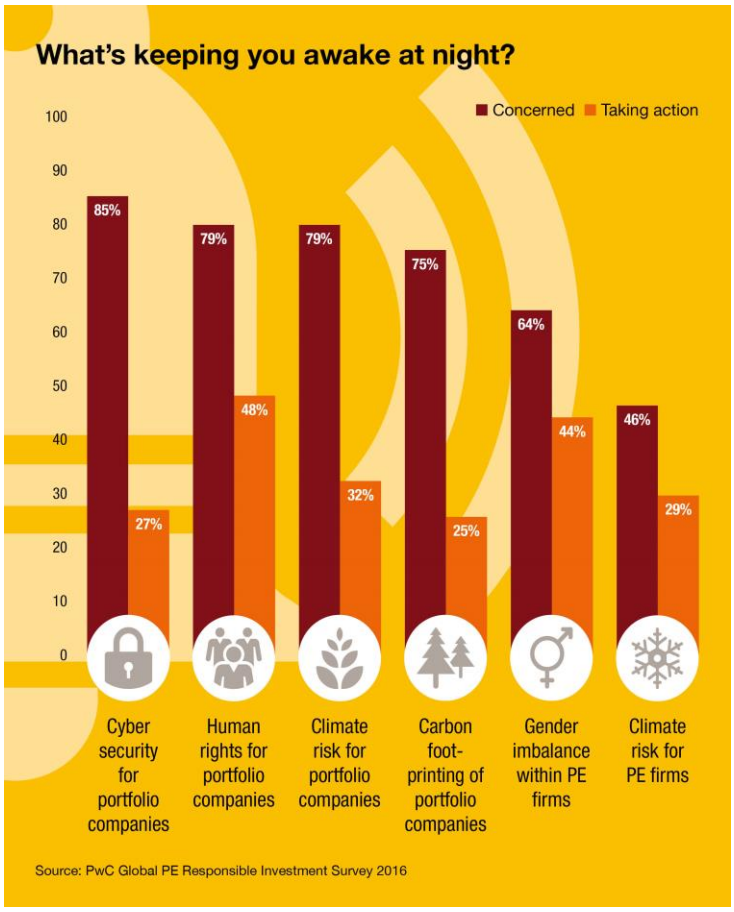

FIGURE 5. Horizon scanning of risks and agendas (PwC 2016.)

Proponents of responsible investment often think that investing can unequivocally combine their own financial interests with larger responsibilities, like nurturing the environment. Responsible investors take responsibility for the actions of investors such as companies and states and they have worries about the risks (see figure 5). If return on investment (ROI) is the most important aim, all other profit-generating activities are excluded from investment activities. Responsible activities carried out by investment targets may, however, also include non-profit making activities. Investors, therefore, do not only take responsibility for the activities of the investee, but also control and limit the liability of the companies or countries in which they are invested. (PwC 2016.)

Another difficulty is limitations of responsibility methods. Traditionally responsible investment has been implemented in three different methods (Joutsenvirta et al 2011):

1. “Listing”: certain unwanted industries / companies are on a black list, i.e. they will not be invested nor given loans. It means, the investors don’t want to be responsible for companies whose actions are considered wrong. The list can be made of singular targets criteria, or by using index of several targets.

2. Weighted criteria (ranking list), which means to search for companies that mostly represent wanted values. This method is quite limited and difficult. Buying a listed share on the stock exchange does not give more money for the company and the invested money is not limited into a certain activity: the company has had its capital already when listing or issuing of shares. Failure to invest in a stock market or to make a list of its preference will not affect the company's business unless the companies so decide. Listing and preference rules can change the world in terms of direct lending and share issues - and only in a rare situation where the activity to be financed would not materialize without investor involvement.

3. The power of owner: at shareholders' meetings, investors seek policies to change the behavior of their own companies to their own aims. However, shareholders - responsible - are often disagreeable and point out different things. Business activities are managed together with other owners.

Responsible investment is possible and morally important. It does not cure the world without contributing to the work of others, i.e. politics.

Cooperation in the market economy makes it difficult for investors to have an interest to anything but convergence and limited resources. An example of investment activity reminds us that in addition to the responsibility of individual actors, we must look at a wider society. For example, if the investor must aim for the highest possible return on the part of the regulator or the clients' declared interests, individual investors can not be expected to engage in low-income or loss-making activities - even if it is the sole responsible business of the investment and even if other investors are willing to support it. (Joutsenvirta et al 2011, 324.)

3.1.5 Responsible capital, ESG and climate age

The deepest purpose of any capital is, that capital can serve as a tool for exchange – that is why it is valuable. We talk about different values, which can be capital, as well as money is. According to Iivarinen (2015, 270), money is a sign of economic value and the owner's right to make a share of that value. Capital can be material or immaterial. When it's numeric, it can be both (money can be material – coins and notes - and immaterial, like bitcoins). I found term social capital in the literature. That consists of three basic elements: trust, interaction and social support (Koivumäki 2008). The idea is logical and can be modified to ecological capital as well, because the same basic elements are necessary except I change social support into ecological support. Responsible capital requires trust. Trust is also needed because when someone invests money into something, it is reliable to be able to trust what the investment seller tells about the investment target.

Communality increases social capital, and contrariwise - that is a self-strengthening process. (Jäppinen 2012, 122-123.)

Does communality increase ecological capital? This rhetorical question is justified, because ecological capital consists of trust, interaction and ecological support, and just like social capital, ecological capital has the same kind of (immaterial) value.

ESG management means environmental, social and governmental value protection. By involving ESGs in venture capital investment is natural. The pressure created by institutional investors gave rise to a breakthrough. However, the actual insight into ESG matters has been to improve profitability, manage risks, and, also have a positive impact on the brand. For example, when reducing carbon dioxide emissions, less energy is consumed, which also saves savings. Understanding that any stage of a production chain may involve violations of human rights provides more information on the risks that might otherwise be missed. The application of

good governance principles can prevent corruption and bribery. (Juutinen 2017.)

If a viable climate (that suits for life) is capital, some day it may be very valuable currency. To model the evolution of Earth's climate, accurate data and long-time series are needed. Currently, there is not enough observation material in research to climate change. "The price of mankind's future is eight billion euros. The world has forty years time." (Kulmala 2017). Academician Markku Kulmala has been researching climate for decades. He leads Finnish Atmospheric Research. Finnish atmospheric research, on the other hand, leads to global atmospheric research. And this research, science, may offer ways to stop global warming.

There is a lot of research about responsibility in the context of investments. For example, World Business Council for Sustainable Development (WBCSD) has published two reports: "Corporate Social Responsibility: meeting changing expectations" and "Corporate social Responsibility: making good business sense" to look deeper human rights at working environments, worker's rights, environment protection, supply chains' environments and management of responsibility included business strategies. (Rohweder 2011, 127).

No matter what the amount of investments is, endless growth is not possible in the future as technology replaces an increasing proportion of the work done by man. The diminished need to work is a real progress of mankind, but for the current monetary system it is a disaster (Iivarinen 2015).

3.2 Artificial intelligence & algorithmic-based decisions

The research of artificial intelligence (AI) started after WWII, when several people independently started to work on intelligent machines. "The English mathematician Alan Turing (McCarthy) may have been the first. He gave a lecture on it in 1947. He also may have been the first to decide that AI was

best researched by programming computers rather than by building machines. By the late 1950s, there were many researchers on AI, and most of them were basing their work on programming computers…it is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable" (McCarthy).

According to Brookshear, an algorithm is an ordered set of unambiguous, executable steps that defines a terminating process (Brookshear 1989). There is no definion for term "algorithm-based decisions", but it means any decision-making that bases on algorithms, like profiling: for example, if a company or organization evaluates certain features (e.g. age, gender, length) or classifies it into a particular category, it is a profile. It is automatic decision-making, when profiling decisions are made by technology without human involvement. Automatic (algorithmic) decisions can be made even without profiling (European Commission).

The secrets of algorithms are not revealed, according to Salminen (2017), there are a few reasons for the opacity of algorithms, like technical reasons (algorithm's operation is not easy to explain), financial reasons (business secrets prevent disclosure of algorithms), social reasons (disclosure may violate expectations of privacy), and disclosure may violate laws on privacy or the terms of service defined by the service itself.

USACM (Association for Computing Machinery US Public Policy Council) has written a "Statement on Algorithmic Transparency and Accountability", that has seven principles about transparency and responsibility for the use of algorithms: awereness, access & redress, accountability, explanation, data provenance, auditability and validation & testing (USACM 2017).

Technological singularity

The self-evolving artificial intelligence can raise its own intelligence when it becomes intelligent. “The basic danger is that there are no fundamental limits for the development of the AI. It is physically completely possible that the particles are organized in ways that allow more advanced computing than the human brain can do. The technological singularity happens when computers develop their own intelligence. An explosive change is possible, and the artificial intelligence could continually improve itself further, creating a so-called singularity where people are left out of development.” (Hawking 2018.)

Technological singularity means the point in time when technology is so radically changed in our world that we do not understand what kind of world is after that point in our understanding of the present - in the research of the future, technological singularity is a hypothesis in which the superhuman artificial intelligence accelerates the technological development and social change of mankind so fast that pre-singularity people can not understand or reasonably predict the future. Technological singularity refers to a hypothesis of prospective studies in which over-human artificial intelligence accelerates the technological development and social change of mankind so fast that people pre-singularity can not understand or reasonably predict the future. According to Vernon Vinge, the exponential growth of technology leads to a point beyond which we can not make meaningful guesses about the future. The acceleration of technological progress has been the central feature of this century (Vinge 1993).

The Big Data Integration

The Big Data era means, that data is generated, collected and analyzed at a huge scale, and datadriven decision processing goes through the whole society. The value of data can be linked and fused with other data. The big data integration (BDI) means, we can generate and collect digital data at an unprecedented scale. We want to analyze and extract value from this

data concomitantly, and make data-driven decisions, to alter all aspects of society. BDI differs from traditional data integration by its volume, velocity, variety, veracity. In industry, the AI is usually fed with a huge amount of raw data, called Big Data: “The Internet of Things also represents a convergence between Big Data and AI. Without a digital brain intelligent enough to allow humans to use an IoT network capable of processing, distributing and collecting Big Data, it will not be possible to set up such a network.” (Srivastava 2018.)

Raw data sources can be both static databases and dynamic and real-time data sources such as temperatures, atmospheric pressures, number of visitors, or number of air particles and chemical composition sensors.

AI is a somewhat generic term with a definition that depends on the case and speaker. In a broad sense, it can mean automatic problem-solving or decision-making by computers, often with the use of machine learning (ML) techniques. In a narrower, more common meaning, it means a human-like decision process made by a machine. Machine learning is a more specific term. It is a technical discipline that provides computers with the ability to learn from data observations without being explicitly programmed. The outcomes of the models can include classifications, estimates, alerts or trends. ML is best used in problems of high complexity, big data, multiple data sources and routine tasks. Deep learning (deep neural networks) is a subcategory of machine learning where, instead of programming using code, the programming is done using models and data to develop a hierarchal, layered, analytical model. It’s often used in e.g. speech and image recognition. (Solita 2018.)

Machine learning (ML) is a subset of AI where the machine is trained to learn from its past experience, and that is developed through the data collected. Then it combines with statistical models, i.e. algorithms to deliver the final results. Machine learning consists of phases, as figure 6 illustrates.

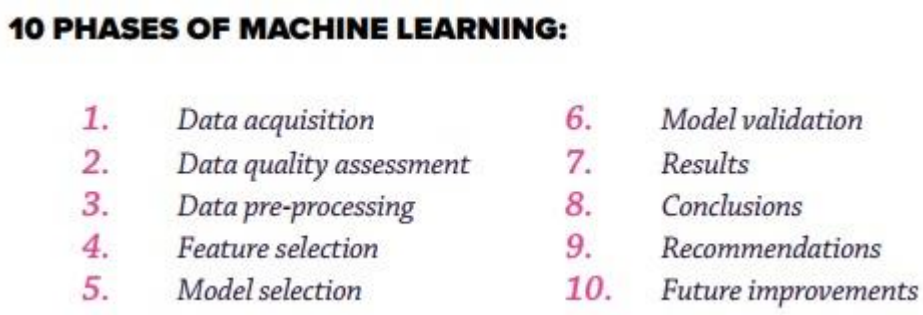

FIGURE 6. 10 phases of machine learning (Solita 2018.)

Computer programs that consists of mathematical algorithms of AI system, analyze raw data and find dependencies between variables. They lead to activities that artificially learn from the same data base. In addition to basic learning, advanced AI knows how to learn deeply, that is, it learns from its own activities and its consequences. Thus, the know-how of AI cumulates, that is, AI gets “wiser”. Nowadays, AI is easily feasible and applied to many tasks. According to Solita (2018) some examples of AI use cases are: information retrieval from images, predicting supply chain, automated accounting, recommendation systems, predictive maintenance, and self driving vehicles, where AI

- collects data from vehicles into scalable storage and computing environment + trains deep neural network models with preprocessed and combined historical data to reach a predetermined destination

- deploys model to vehicles with specialized computing hardware integrated with sensors + makes vehicles travel to destination along best route and speed determined by AI based on historical and real-time data

- collects data from the fleet of vehicles and teaches the AI continuously which allows the AI to adapt to new situations

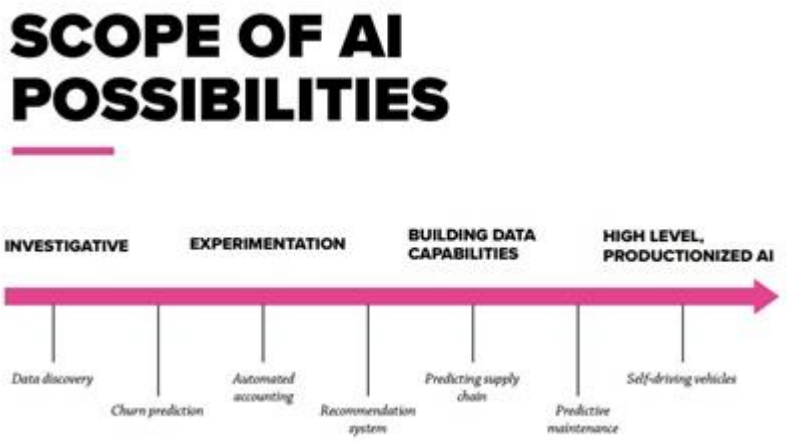

FIGURE 7. Scope of AI possibilities (Solita 2018.)

According to figure 7, the best cases for using AI are usually when humans are not willing to make repetitive decisions of suggestions based on large dataset. The calculation power of computers is constantly increasing while its price decreases with process technology development margins. There will be no shortage of enormous mass of data, as real-time data is generated and stored at accelerating rates through sensors in objects and machines. Billions of euros and dollars are invested in software architectures and algorithms, and new innovations are constantly being made. (Solita 2018.)

Machine vision, character recognition, spoken language learning, and machine translation are the basic applications of AI. On top of them, special applications are being built for different devices and different applications. For example, robotic car monitoring- and control systems have numerous artificial intelligence applications. (Solita 2018.)

AI cannot learn human comprehensiveness. Through machine learning and deep learning or advanced character recognition, the machine does not have the feeling that man gets when he walks in the summer morning from a fragrant pine forest to the sea shore as the sun rises and birds sing. The machine does not experience what people feel when they have a salty breeze on their bare skin warmed by the sun and remembering the experiences of childhood. (Chydenius 2017.)

The Russian President Vladimir Putin said in 1.9.2017 that whoever achieves a breakthrough in artificial intelligence, will rule the world (Tekniikan Maailma 2017). There is a concern, what do we know about artificial intelligence. If economic growth, competitiveness and citizen control were not the basis of human welfare and happiness, then artificial intelligence would be a good thing. It is justified to ask, who or what is going be the future investor, and what happens if it will be AI.

The venture capitalists have an important role in creating economic growth and jobs. They invest in growth companies, develop them, and sell the company in better shape for about four to five years. Some companies are listed on the stock market, some are purchased by an industrial investor or another venture investor. By pointing to the buyer that the most important ESG-issues have taken account, it can reduce investor's concern and perhaps allows a better investing deal (Juutinen 2017).

Humanity must solve even bigger threat than climate change and population profiliration, say cognitive scientist Michael Laakasuo, Jussi Palomäki and Mika Koverola. They claim that super intelligent artificial intelligence will be created before year 2060, within 50% probability. Investing in artificial intelligence is at least as important as climate protection (Laakasuo & Palomäki & Koverola 2017, as cited in Hujanen & Åkman 2017).

This scenario of the reign of artificial intelligence sounds quite threatening. It would proceed as follows: first, somebody succeeds in creating so-called general artificial intelligence. It is a technology that has a human-like ability to flexible thinking and decision-making (these both are abilities of investors). Assets under Management (AuM) are almost doubled by 2025, rising from about 85 000 billion in 2016 to 145,400 billion by 2025. The increase in the funds being managed means that the funds will continue to focus on fewer and more smart-minded firms. The winners will be those who take advantage of technology and find growth in new areas. (Bäckström 2017.)

Fund managers need to keep track of technological developments very carefully. Machine learning and artificial intelligence change the way in which research and portfolio management is carried out. Enhanced data processing and the potential of predictive analytics, artificial intelligence and big data provide new ways to analyze investments. Robotic processes follow and analyze public companies as well as other available financial and non-financial data. A good example of such new solutions is a machine-based tool that produces business analyzes in support of a credit decision in natural text. Another good example is our service where business data can be combined with climate data to support investment decisions. (Bäckström 2017.)

In the future some of the fund managers could call “technology company”. They generate revenue by harnessing the most powerful computers and the largest data repositories for data processing, identification of correlations, and testing of investment strategies. These tasks are great for computers. Software biotechnology revolutionizes administrative services (middle and back office), while the block chain can have fundamentally impact on industry processes. Technology simplifies risk assessment when cloud-based computing algorithms relate to risks and build scenarios more easily and faster than before. RegTech, in turn, provides effective ways to meet regulatory requirements and increases internal control capability to act proactively. To understand the technology and exploit the opportunities it brings, asset managers need technology and data specialists. Bäckström claims, that it’s not clear, is the future core asset manager an expert of technology and not just an analysis expert. (Bäckström 2017).

Once the general artificial intelligence has been created, e.g. by digitizing brains, it can be enhanced. As technology develops, artificial brains will work faster and faster. In a short time, there has been rapid development (Heikkilä 2017). It does not get tired and it thinks faster. It is capable to do science more efficiently and faster than people are capable. At some point, the general artificial intelligence can make copies of itself and discuss with

their copies. We talk about an advanced general artificial intelligence. It is like a Human being + (plus), then we talk about “artificial intelligence +”, which is capable to make even more sophisticated version of itself. And again, and again, it creates even more advanced versions of itself (Laakasuo 2017, as cited in Hujanen & Åkman 2017).).

This kind of AI that is unimaginably much more advanced, would bring a huge number of threats with it. For example, problem of human dignity: artificial intelligence can be complete neutral of hostile to people (Laakasuo 2017, as cited in Hujanen & Åkman 2017). According to Mo Gawdat (2018), technological development has so far remained in human control. In the next development wave, machines learn themselves and they’ll adopt the information that people produce. It is quite sure, that in the next 10 to 20 years there is AI which is smarter than people. “Some say that we can control those machines through regulation, technology and firewalls. We cannot control even hackers”, says Gawdat (Kauppalehti 2018).

All this sounds like a science fiction, but according to Laakasuo (as cited in Hujanen & Åkman 2017), it is unavoidable to ignore the thing by saying its nonsense. The rapid development of artificial intelligence has already begun and is being taken seriously by more than 8,000 researchers in the field who have signed an open letter to the Future of Life Institute (https://futureoflife.org/) The Future of Life explores factors that threaten the existence of mankind.

The point of creating artificial intelligence is to give for it a human-like ability to flexible thinking and decision-making. If artificial intelligence can not understand what holistic well-being on a very large scale is, then it can create dangerous and destructive solutions. In many areas of society there is discussion of automation of law, automation of factory work, automation of language, traffic and freight transport. For example, Kela (Finnish national pension institution) has tried using its chatroulette service in its customer service (Ilta-Sanomat 2017). In Helsinki, a robot has pre-processed over 8,400 apartment applications in July-October. According to

HOAS (Helsingin opiskelija-asuntosäätiö, Helsinki student housing foundation) customer relationship manager Riitta Pulkka, it would have insisted almost twice as much for people to do the same work, which means huge savings and faster customer service. The experiences of software biotechnology have been good, and Hoas expands the robot's responsibilities this fall. Since October, it has also pre-processed applications for exchange students. The next step is to streamline resident communication. The plans are also to extend the use to financial management tasks. (Taloussanomat 2017).

In HOAS, the robot is now in pilot stage. The Foundation is undergoing an information system reform. That's why Matti Tarhio (chief executive officer) does not know can the use of the robot save money. "We are exploring opportunities, but it can be said that the robot has increased its efficiency, and the savings will come out later," says Tarhio. Software booths are used a lot in financial and energy, as well as in healthcare. For example, banks have made use of robots to provide quick loan decisions. HOAS is the first operator in the real estate industry to use the robot as a support to customer service (Talouselämä 2017).

Artificial intelligence has many advantages compared to humans: AI does not suffer from lack of sleep. Also, it does not suffer from lack of work, and like humans, it is does not need social contacts to stay healthy (Mäenpää 2012). Artificial intelligence has already been hired to handle rental agreements and housing applications – it saved 300 hours of work. The robot completely handles the pre-treatment of applications. For example, it checks for applicants' credit information whether they have other applications for processing or whether they already live with Hoas. From the customer service providers, the working time is approximately 2 minutes per application. Artificial intelligence (robot) processes the list of received applications four times a day: twice a night, once in the morning and once during the day. When pre-treatment is carried out at night, customer service agents will be able to resume their applications right from the morning. According to HOAS Customer Relationship Manager Riitta Pulkka, the robot has pre-processed over 8,400 applications in July-

October. This time around 400 hours have passed since almost twice as many people went to the same amount of work, about 700 hours ago (Talouselämä 2017).

There are several issues that encourage digital development like artificial intelligence. One main thing is salary costs: “average salary is 5300 euros/month, but training requirements vary – the situation of investment advisors (= wages of fund managers / brokers) has been wild and free” (Oksanen 2017). Finnish Markkinointi-instituutti arranges online investment advisor education (https://www.markinst.fi/tutkinnot/121/sijoituspalvelututkinto-apv1--verkkokoulutus).

3.2.1 Can AI understand human values?

For artificial intelligence to understand human activity, it must be taught human values. The research of artificial intelligence is taking big steps. One of the worries about advanced artificial intelligence is that artificial intelligence should be able to control its own behaviour to more morally acceptable without human control. Kaj Sotala’s project concentrates on this issue and it is supported by Future of Life Institute, with the money donated by Elon Musk for 20.000 dollars (Berschewsky 2018). The problem is, that moral questions are related to concepts such as human rights, that can not be formally defined, but somehow, they should be taught by them.

According to Finnish AI-researcher Sotala, it is unclear how does learning of moral values differ from the learning of concepts in general. There is no information, can the teaching of values be taught with the same algorithm of learning, that is used in every teaching processes in teaching the artificial intelligence. For example, one question in moral psychology is, whether man’s tendency to experience repulsion or disgust, such a thing, which affects his moral values? This would make human values more complex to teach, than other concepts are, as we look at the learning process. The question is, whether the artificial intelligence should get a

counterpart of the inhuman feeling, that it would learn morality in the same way as humans. And if so, how strong? To teach feelings to a machine is not straightforward. For example, embodiment -question. The feeling of fear comes after noticing danger, which leads to physiological reactions. Adrenalin excretes, which makes the body escape of fight. Does the artificial intelligence need that kind of response? We want to find out, how likely it is that artificial intelligence could perceive the world as a human being (Berschewsky 2015).

After the review, the second aim is to study whether the deep learning method (a method of research artificial intelligence by means of algorithms to make high-level abstractions) can be used to get artificial intelligence to learn moral concepts from an appropriate initial data. To create the right set of data would be the most important task now. (Berschewsky 2015).

3.2.2 Algorithmic transparency

The author of a Pilot Project on algorithmic transparency, Liisa Jaakonsaari: “Citizens need assurances that machines are treating them fairly. A discussion on algorithmic accountability and transparency is missing from Europe’s digital economy framework”. Jaakonsaari also asks, “Who sets the agenda on algorithmic accountability?” - and who is accountable for decisions made by artificial intelligence? (Euractiv 2016.)

“Algorithms are the fundamental, invisible building blocks of our digital societies. There is no legislation, best practice or quidance on algorithmic accountability or transparency. A dialogue among tech companies, consumers and regulators is urgently needed globally to ensure that algorithms are audited, and that citizens’ rights are safeguarded. The digital landscape is changing rapidly with the rise of powerful computers, machine learning and big data. Intelligent self-learning algorithms, often referred to as machine learning or deep learning, are linked to the development of Artificial Intelligence (AI). AI will transform our society in fundamental ways, revolutionising efficiency in industry and services, but

the question of ethics in this transformation remains paramount.” (Euractiv 2016).

Algorithms will make decisions in the future, consumers have an interest in knowing what data is collected and how is it fed into decision-making algorithms. Consumers have no way of knowing if they have been discriminated against by an automated decision, for example on a bank loan or a job application. Consumers also lack awareness about the role of algorithms in digital societies. Jaakonsaari insists, that improve transparency to ensure that any decision-making that significantly affects citizens is not outsourced to machines. EU has taken some action to strengthen consumer rights but lacks a general framework on algorithmic accountability and transparency. The issue of algorithms was loosely addressed in the Commission's Platform Communication published in May 2016. The policy document called for "greater transparency" so that users "understand how the information forms the basis of purchasing decisions or influences their participation in civic or democratic life". In other words, more efforts are needed to raise consumer awareness about the role of algorithms in digital societies (Euractiv 2017).

Despite the EU’s efforts to date, the influence of algorithms goes far beyond internet platforms, online credit applications and e-recruiting practices. Therefore, a more comprehensive framework on algorithmic accountability and transparency is urgently needed - it is not enough that the issue of algorithms, AI and ethics be governed by tech companies themselves, especially when several notable names are missing from the Partnership on Artificial Intelligence to benefit People and Society (there has been cooperion between Google, Facebook, Amazon, Microsoft and IBM). Self-regulation by the tech industry is insufficient to guarantee accountability and ethical AI. Audits on algorithms should be performed by an impartial authority.

“As the digital revolution gains pace, we must take steps now to build a framework on algorithmic accountability and transparency in Europe to uphold free speech, the free flow of information, fair competition, as well

as, privacy, trust and democracy in digital societies. This framework should provide legal certainty for companies by addressing the issue of algorithmic best practice and accountability and enhance consumer trust in the digital transformation whilst preserving companies' ability to innovate. However, the question remains: how we can hold algorithmic decision-making accountable without placing the burden solely on citizens, but rather on those who design these technologies?" (Euractiv 2017)

A well-known user identification procedure, captcha (Completely Automated Public Turing test to tell Computers and Humans Apart) which is a challenge-response test used in computing to determine, whether the user is human, can distinguish human users from robots. Today, a machine is beginning to manage to identify images and two visually twisted words, with nearly human precision. It is very easy and accurate for a machine to recognize the text in general, but it is very difficult to recognize the twisted text in captcha images, as individual letters are unlimitedly twisted in different ways. Vicarious, an artificial intelligence company funded by Mark Zuckerberg and Jeff Bezos, however, has succeeded in creating artificial intelligence that can make that identification. (Tivi 2017).

3.2.3 Risks in responsible invests in AI-based decisions

The investor assesses the risks and potential of the investment and their impact on the value of the asset (measured in cash). The factors of responsibility, that mostly affect to the value of investment are shown in figure 8, the elements of responsibility in investment decisions. In addition, the investor estimates the object's suitability to his/her own values (Joutsenvirta et al 2011, 315)

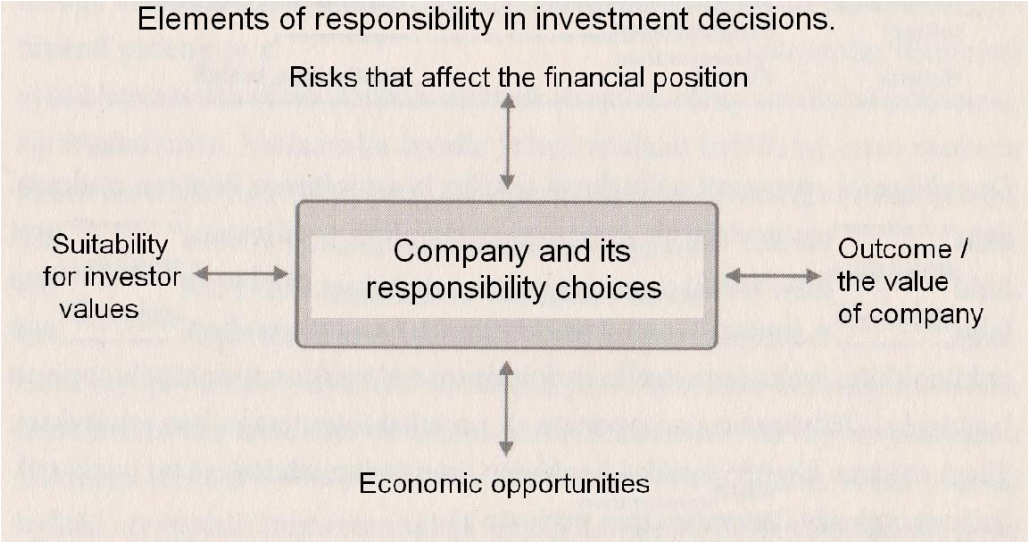

FIGURE 8. Elements of responsibility in investment decisions (Joutsenvirta et al, 2011, 315.)

Determining the risks, opportunities and real value of an investment is an important step in the investment process, regardless of whether it is a company's share, project, business of wholly owned enterprise. Due diligence (the term is derived from the American stock trading law) obliges brokers to carefully investigate those companies they advice their clients to invest to. Responsibility aspects are considered as risks that undermine the company's financial position and hence its ability to provide return on investment or repay the loan financing. But, it is considered more and more responsibility as an option to improve the economical position of a company. Next figure (9), shows most common types of risks where there may be questions of responsibility behind (Joutsenvirta et al 2011).

Risks and opportunities of responsible investment

	Risks	Opportunities
Strategy	Strategic dead end + need of change	Ability to take future challenges
Technique	Need for investment	Ability to solve problems that concern responsibility
Products	Market risks, aging products	Product development, innovations
Society relations	Threats of operational conditions	Attractive job
History	Responsibilities	Good reputation, brand

FIGURE 9. Risks and opportunities of responsible investment (Joutsenvirta et al 2011, 316.)

There can be disadvantages in the way of finding environmentally sustainable investment concept and risks in responsible investing. What kind of investment participants and operators there will be in the future, we don’t know.

Risks are real, if we look at this from the point of artificial intelligence. "There have been such breakthroughs in the unconscious artificial intelligence that it's hard not to believe. For example, Deep Mind (owned by Google) has already developed an artificial intelligence, that has learned to play 70 different Atari console games by itself. Its only goal was to maximize the score, and it made a conclusion that it achieved the goal, for example by killing virtual characters (Laakasuo 2017, as cited in Hujanen & Åkman 2017).

Laakasuo (2017, as cited in Hujanen & Åkman 2017), notes that the development of artificial intelligence may have happy end, but it is unlikely. One of the key reasons is that all the artificial intelligence agencies are currently in competition with each other. For example, someone is successful in creating artificial intelligence and six months faster than the

others. His creation has six months to manipulate the world so that others can not. When in a hurry, security is first reduced because it slows down.

The other thing is a more abstract argument based on information theory and entropy. Things can be disordered in more cases than in order. For example, a nuclear power factory can be assembled correctly only in a few ways, but it can be assembled incorrect in many ways. This also applies to artificial intelligence (Laakasuo 2017, as cited in Hujanen & Åkman 2017).

3.3 The conclusions of theoretical framework

All this material about sustainable, responsible investment and AI, that I have collected, has raised a lot of questions for me to find out, and those questions I used creating the survey. Still, there are some questions that those professionals (politicians, software programmers, investors) probably have also asked from themselves. They haven't necessarily heard about PRI (Principles for Responsible Investment), or about ESG aspects.

A limited planet can not withstand over-consumption. It is estimated that five globes would be needed if people in developing countries would live as in the developed countries. The regeneration of nature and its richness, are important features of wealth and sources of economic value. It is necessary to redefine the correct content and purpose of the economy, and to create a new development model that is appropriate for the society of moderational prosperity (Joutsenvirta et al 2011, 348).

Instead of economic supremacy, we should want a culture that appreciates people and nature (Ulvila & Pasanen 2010). Pursuing to moderational prosperity demands changes in legislation as well as in people's attitudes. Finnish law of limited companie's says: "the purpose of the company's operations is to generate profit for owners". It should be moderated so that artificial intelligence would not misunderstand the point. Disruptive technology means new technology that makes the old technology or

process redundant and changes the markets and earning methods that used to be based on it (Lammi 2013).

Digitalization means the integration of digital technology into all life and activities (Heinämäki 2015). When algorithms are programmed to learn independently, it takes them further away from human control. Self-taught algorithms will dominate digitalization in the future. Because algorithms also make mistakes, it causes risks we can not even imagine – therefore we should start to develop responsible digitality and responsible algorithms.

4 RESEARCH PROCESS: DATA COLLECTION AND ANALYSIS

This is a research-based development. The research has concentrated on examine the future of responsible investment in the algorithm-based decision-making environment. The development part of this study handles the need of ethical and responsible development of AI.

This kind of comparison of AI and responsible investments has not been done before, and ethics studies are not included in today's business education at least in Finland. Algorithms must be programmed so that they learn to recognize the need of sustainable development in investments. The development of AI will inevitably emerge in global and national legislation as it affects so much the humanity's future.

4.1 Data collection & implementation

The schedule has been flexible. I started the whole process in October 2017 by collecting material for the theoretical basis. That was mostly done by the end of December. The questions were ready in the beginning of January, and 5. -20.1.2018 I had all answers from the experts. The questions were sent by email and Messenger (that was asked by some interviewees). I sent questions for 22 experts, like software engineers, climate change researcher (a professor), bank information development manager, education manager, etc. The sample was narrow, but the persons had been selected so that their expertise would make the knowledge enough deep, extensive and versatile. I analyze the data partly by comparing answers to each other. Because I used open questions, there are much dispersion /diversity in the responses, which also tells something about the subject of the thesis.

According to Hirsjärvi et al, 2010, themeing, typing and content analysis are considered the most common method of analysis of qualitative data (Hirsjärvi, Remes & Sajavaara 2010, 224). Themeing has proven to be a good method of analysis when seeking a solution to a practical matter. The themes can be used to find answers to questions directly presented

and relevant information to the research problem. When classifying material in a thematic area and grouping it into entities that are more easily interpreted, it is crucial to find the themes that are essential according to the research problem through which the material is examined. (Eskola & Suoranta 2003, 178).

Themeing requires dialogue between material and theory, so that the analysis of the material becomes sufficiently profound; discrete quotes are not enough to guarantee actual conclusions (Eskola & Suoranta 2003, 178). In the content analysis, the material is studied through material-based, theoretical or material and theory-based classifications. The survey material was gathered by email and by Messenger, and questions and answers were processed so that individuality disappears – the point is to get the main message without raising the interviewees. As using the content analysis, material is studied by isolating, looking for similarities and differences in search and summarizing. Content analysis is a text analysis that focus on already existing textual or modified material. The texts to be examined can be almost anything: books, diaries, interviews, speeches and discussions. Content analysis aims to create a comprehensible description of the phenomenon to be investigated, which links the results to the wider context and other findings of the phenomenon (Tuomi & Sarajärvi 2002).

To create the data that I use to answer the research questions, I have read the theoretical material currently available, and based on that information I formed the survey (more detailed information in chapter 4.1). This thesis theory is based on the material from expert articles and blogs, and the survey bases on semi structured interview of several experts. The timeline for gathering information was between October 2017 to January 2018 (approximately 4 months). As processing a subject that will focus on future evaluation, requires latest information, all the obtained information is theorizing evaluative.

The methods and implementation are described with reference to the research literature. I clarify and implement the research plan: how and where to collect the data and how I will analyze it. Research strategy, collection method of research material is explained. To better focus on the questions and the survey itself, I searched for the problem of future sustainable and responsible investment decision-making by creating a fishbone analysis of artificial intelligence's problems, according to Ishikawa's fishbone diagram (figure 10). I have added "Technology" and "Methods" into the basic fishbone options to expand the alternatives to drive my thoughts more in the direction that best suits the topic and more specifically deals with it. The basic chart of Ishikawa's fishbone diagram:

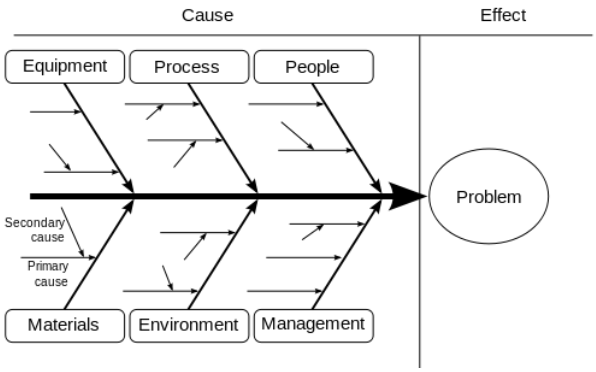

FIGURE 10. Ishikawa's fishbone diagram

In this case the problem is, will there be environmentally sustainable allocation of assets in artificial intelligent era, can it be solved by creating a friendly artificial intelligence? Can artificial intelligence be managed by humans after certain development point? Is it possible, that artificial intelligence stops listening to us? Who controls AI algorithm creators? Answers to these questions I have found from sources of this thesis.

EFFECT (i.e. the problem)

What kind of investor would AI be? = Will there be environmentally sustainable allocation of assets in artificial intelligent era and can it be solved by creating a friendly artificial intelligence? Or, can artificial intelligence become even better investor than human is? What qualities AI

might need and what kind of features and abilities of AI could be the most useful and helpful for human and mankind?

CAUSES

= (list of features / factors, that may cause the problem)

Equipment - software & hardware, informing, safety of information, leaks, power of information, who controls AI, who owns AI, where the AI exists, to whom the AI affects, what AI may control and manage, can AI manage itself, how is AI applicable, good software applications, legislation, AI - legislation and who decides it, is AI a servant of boss or both, can it be both, can AI be stolen? (Page 62, “5.2 Future artificial investor – SWOT”)

Process - timeline, development of AI, readjustment of humans and animals, unfair income distribution -> terrorism, cyber war, food war, machine war, what role humans have if AI takes power? Can we set the right questions to solve the problem about artificial intelligence working among us? Do we trust AI? How much we have time [if the climate chance is real and changes our environment permanently to wrong direction] to develop something that is more intelligent than we are?

People – investors and their ethics, values, education, poverty, culture, religions, believes, human rights. Production of falce information: reader (or any recipient of information) need to have a balance between truth and lies – that is the core while working within false information. Readers can be suspicious, but they are not so paranoiac, that they believe all information is incorrect. There is a possibility that even the readers who are in balance will begin to believe in mistakes or they will not find that truth is false. Earlier beliefs and opinions affected how readers interpret the information. When readers believe something is true before they examine it, their opinions are likely to support their earlier thoughts. This may lead readers to believe in false information (Libicki 2007).

“While information on the web has tremendous positive effect on the lives of billions of people worldwide, false information has many dangerous and

harmful impact! *Hoaxes* are deliberately fabricated falsehoods made to masquerade as truth.” (Kumar et al 2016)

Validity of materials needed - money - bitcoins (Bittiraha 2017), reliability of climate researches and other informations that is available

Key reasons for the demand for bitcoins include the following factors:

- bitcoins are scarce and can not be falsified or copied. They are “value-preserving”, i.e. they can not be printed out of nowhere, unlike the euro
- bitcoin enables high level anonymity compared to other digital payment methods
- bitcoins can be used to move value near (mobile), or far (to the other side of the world), easily, quickly, and almost for free
- bitcoin is a decentralized monetary system with no interest groups, its program code itself is open and all transactions are public information
- bitcoin’s monetary policy is not governed by central banks, it has clear rules in source code – bitcoin is a money transfer protocol, that represents something useful and it’s for some users it is kind of future-investment, that is considered to become the money of future

Reliability and validity of researches and all those you have access to significant and original research results, increase safety and is necessary, because the decision-making is dependent on valid and reliable information.

Environment - climate change, storms, hurricanes, pollution, traffic, food production, habitat areas’ development

Management - thoughts of leaders: values, education, responsibility, understanding, ubuntu - According to Desmond Tutu, ubuntu refers to the main doctrine of African philosophy: what it means to "be a man". Definition of ubuntu is, that humans are openhearted and uses power for others’ benefit. People who have ubuntu, share what they have and

through it they confess other people's humanity, which is inextricably linked with their own humanity (Gandhi). Tutu also mentions, that "if I despise you, I despise myself" – this kind of thoughts maybe very difficult for an artificial intelligence to understand, but these thoughts are all important questions to answer when thinking of values and responsibility. If artificial intelligence is better in decision-making, there is sense in developing it furthermore - if it's worse than human, it's useless.

Methods - expensive ESG information: one problem in using ESG facts that would offer the latest reliable information about climate change, social rating and governmental information, is that ESG information has become a paid service. That payment may be a threshold question to small investors.

Technology - is there going to be new material for computers and robots – to motors, weapons? Can lifeless material learn? Can lifeless materia be combined or mixed with human flesh and get it in action, make it "alive"? With that material, is it possible that AI could smell, taste, feel (physical & mental), suffer, get ill, heal, anticipate, sense, vaistota (like birds can sense a storm coming), die, born, give birth, cuddle, spirit, enjoy the atmosphere, be a conscience, hate, rejoice, buy, sell, steal, judge, bully, embarrass, unify, support, enjoy, make art, realize mistake and fix it, realize that it made a destruction, regret, feel sorry, help, take care, see if someone needs help ("A Bernhardine on a mountain with a barrel on his neck"). Can AI understand, what means jeopardizing, when something or someone is getting into endanger? Can AI be set responsibility? Does it realize, what means responsibility? Will it understand what is danger and can it prevent accidents (or even bigger catastrophes, like hurricane disasters) independently by using all senses and calculations that are available, but more precisely and more efficiently than human beings? Could it act as a doctor, like do surgeries or so? Could it entertain? Could it eliminate poverty, loneliness, hunger and pain and give hope? Would it work as a colleague with people?

Is it possible to generate material that can be mixed or combined with human flesh, nerves, and brains, and make it operational? Hugh Herr has gone far with proving, that there are materials that can learn to ”feel”. ”Hugh Herr, who heads the Biomechatronics group at the MIT Media Lab, is creating bionic limbs that emulate the function of natural limbs. In 2011, *TIME* magazine coined him the “Leader of the Bionic Age” because of his revolutionary work in the emerging field of biomechatronics – technology that marries human physiology with electromechanics.” (MIT) - Herr aims to synthesis, a combination of two or more existing things, so that a new case is formed in which the compound matter becomes more than just the sum of its parts (emergence).

4.2 Survey – the background of questions

When the information for the reference frame of this material-based study are basically combined, it is essential to find the right people for research query. I limit the query and mainly focus on investors and AI-developing / scientific professionals of the key group, because I estimate that they are the ones who have the right ideas and frame of thinking to answer my research questions.

I lead the actual research questions from these general pre-reflection, concerning the topic for investment decisions, because this is the basis to create the actual frame for survey about value of responsible capital in future investment context. In general, these questions and pre-reflections help to create a complete concept of what I chase with final survey:

Has the financier / fund manager signed the PRI -principles? By signing the UN-sponsored PRI principles, the financier undertakes to develop their own responsible investment activities and report annually to this work in public. In practice, this means that an investor may require a PRI signer to be more prepared for responsible investment.

Does the financier / fund manager have a reliable and valid responsible investment strategy? Creating a strategy for responsible investment is the

starting point for all activities and demonstrates commitment. If such a strategy is lacking, there are no actual views, principles or practices for responsible investment.

What does the asset manager's responsible investment strategy include? Why is the asset manager investing responsibly? Responsible investment is not greenish or charitable, but it seeks investment for better risk management and more revenue opportunities. This world of thought should also appear in the justifications of the asset manager, and preferably be part of the whole investment activity, and not just the marketing of individual investment products.

In practice, the investor wants to know what kind of responsibility aspects, ESG matters, are involved in the fund manager's investment decision-making. The investor also wants to understand how the responsibility perspectives in practice are considered in the investment fund. The most common approaches are ESG analysis and active ownership and influence.

What kind of responsible investment resources does the asset manager have? How resources are utilized? The investor wants to know if the asset manager has enough resources and expertise to make responsible investment. As a fund manager and investment team make practical investment decisions, they should have as much information and expertise as possible on ESG matters and their significance.

Can a financier / fund manager tell about examples where the responsibility aspects have influenced investment decisions? By asking concrete examples of action, the investor gets a better picture of the asset manager's practices. The examples also show whether the activities described by the asset manager are real.

How does the asset manager report on responsible investment activity? The investor wants to find out how often and what form the asset manager reports on his / her responsible investment activity. An investor can

request an example report. The purpose is to follow how the asset manager moves forward. Reporting can include, for example, carbon footprint of investments, ESG score, or examples on influence discussions.

4.3 Description of data

This is a future-oriented research, which means that there are many assumptions in the answers, which are qualitative. The questions, that I present for the interviewees come up from the main research question concerning on what direction future investments will develop (With the help of AI, could responsibility of investments be the major competitive factor in future investment decision-making?), and, of course, from the sub-questions (Who or what may decide, what are the future investment targets and based on which information, the future investment decisions will be made? - If AI can seek for, perceive and sift responsible investments from all investment targets and offers – can it also understand the value of findings and utilize that information correctly? – Do portfolio managers have enough capability to offer valuable information of responsible investments for their clients?).

I write answers by theming and referencing from the original answers that were given by interviewees, partly using exactly the same words and expressions they used, because these answers are from professionals of different industries. This method brings out similarities and explanations for the phenomenon. The answers are combination of all answers per question. The questions were sent to 22 persons, 3 of them thought they are not capable to answer at all, 11 gave no answer at all, and the rest 8 did answer. 5/8 answered to all questions, 3/8 answered part of the questions. Only 4 interviewees answered directly without a reminder message. The sample response rate was 36%

4.4 Analysis of the answers

Next content analysis gathers the field of thoughts, that the keygroup's experts expressed about AI’s use in future investments based on their current knowledge and experience. This theming builds the frame of the recommendations to solve the issue of AI's development as an investment tool, that are itemized in chapter 5. Themes are following the order of original questions. To find the answer for the main question, the thematic answers are referenced throughout the research material. The connection between the research material and theory, so that the link between research material and theory remains, is essential. Next, I will present those 8 themes that emerged in the study:

Theme 1: Future estimation of how AI will act in investment decision-making now, or after 10 to 20 years, and is the use of AI increasing.

Companies are currently using AI in board work to determine the attractiveness of different marketplaces and, in practice, decision-making in whether or what marketplaces should their operations or supply of services be expanded. AI can work well for supporting human decision-making, and in next 10 to 20 years - AI can be used to make even more autonomous investment decision-making solutions more widely. The AI will have an impact on investment decision-making and examples for AI use can be found from AI applications in other business areas than investments.

All interviewees agreed, that there is absolutely zero chance that it would not increase. AI usage is exploiting right now, and the development will only grow more rapid. Unfortunately, AI will take over many jobs from humans in the very near future. Many companies do their own business case calculations about how they could be more cost effective, and the way is to benefit from AI. If organizations would not see benefits or try to adopt AI independently or with a certain external partner founding that it would be too expensive, so no resources would be used for AI.

Theme 2: The knowledge and trust about development of AI's decisions.

When following the AI debate in the right channels, it's possible to see that early adopters are willing to try new applications. There is a need for clear, popular, no-nonsense information. The deeper you need to go, the harder it becomes to find relevant information about it, because researchers have different assumptions. Already now part of the investment decisions are based on algorithmic decision-making and projections for the future trends. If the background information for the invest decisions are available, most would trust. The investment service provider should provide for customer the elements on what basis the recommendation is based. AI is just a software and like any software there are varying degrees of quality out there. Reliability depends on developer.

Theme 3: Awareness of using AI already, and the possibility that AI replaces the interviewees' position at work.

People had experiences from customer point of view, at telephone and chat bots. Those were easy to realize there's a robot on line. One believed, that at this moment he is not using AI at work, as far as he knows. All the rest we sure, that they use it, some of them create it, it is their job to develop AI. AI could be a great help, but it couldn't replace skills development work, and managing work.

Theme 4: Acceptance of AI leading the company or being a subordinate.

Mostly opinions were negative, but there were such thoughts that it could, for example in board level acting as a member of the company's board of directors. Some said no, some said yes or "why not". This seems not to be an option in how to use AI, rather AI would serve as a complementary and useful tool in many cases.

At this moment, some would accept AI as an employee. Some said no, because a machine will only do exactly what it is programmed to do, even if it has self-learning capabilities. Opinions depend on the employee's task.

Theme 5: Clients' awareness of dealing with AI when being a client.

Some clients are asking for it. Part of clients are not interested at all who is serving them. Almost all interviewees thought it's ok to tell their clients that AI is serving them / processing information concerning the client.

Theme 6: Awareness of ESG (individually / company awareness).

Half of interviewees had never heard of ESG. Some people who make decisions about AI's development and investments, have never heard of ESG. Some realized and commented that this is an issue that should be corrected. Half of the answerers were positive, that their company has an ESG strategy. This tells, that some companies appreciate ESG matter high, some have hardly heard of ESG.

Theme 7: Responsibility of AI, awareness of it's character.

The results of the responses are quite dispersed about can they trust AI and its capability of making decisions. This is something people have very different opinions about. There is not knowledge of the future and about technological singularity, and some told that they have no information about AI's possibility to have "a character". Reliable – in investment decision-making it is all about information and making decisions on basis of the information what we have at the precise moment. AI can count all possible information what is related to some specific investment instrument.

Interviewees are very aware of AI’s development, but they are confused about AI’s capabilities in making decisions. It is somewhat good and bad at the same time. All answers were positive that AI could make decisions that produce more sustainable investments than humans.

Companies already use Machine Learning based algorithms to do predictions on stock consummation and it makes some of the actual procurement decisions. Some had heard about such solutions.

Theme 8: The effect of AI for disappearing of traditional banking.

This was considered a hypothetical question. The main opinion was, that in the future, banks will still act, but their purpose may change according to how well they are preparing to adopt new regulations and what strategy they will choose to start with new regulations, i.e. whether banks try to be self-sufficient in the provision of new services or to choose suitable partners to produce new type of services.

5 FINAL CONCLUSIONS AND RECOMMENDATIONS

Through this study, I have discovered, that AI already has penetrated irrevocably to our societies and legislations. The findings show, people know a lot about AI, but still there are huge doubts. There are many uncertainties about AI's safety when it's used in decision-making as information collector. Automation and increasing use of AI has unwanted consequences for the action of all parts of all societies, and there is no reliable answer how those questions, like increasing unemployment, will be solved in the near future. Based on this, the good thing is, that partly these threats have been noticed already among some individuals. By doing so, there are unlimited possibilities to develop better investments environment that accounts ESG aspects more efficiently and sustainably than before.

In the survey, the questions mostly indicate the awareness of development of algorithm, and is there connection between AI, ESG and leadership. The timing is correct, because we are at the gateway to the real digital revolution, now is the time to set serious questions of AI's future, and process and analyse the subject diversely from many sides.

Some limitations of this study I found in collecting the answers. Specialists that I interviewed, are very busy, why they also are very difficult to reach. Often, I was just able to talk to their assistants. My questions are easily applied, and I did so when I sent questions for the manager of responsible investment in the Evangelical Lutheran Church in Finland – at first the manager was very keen on answering, but after all responded: ”I cannot answer your questions, because I have not faced the subject (AI) earlier. You need a person who has been involved merely with AI-solutions of investment, this way you get more relevant content to your survey”. After all, manager's answer was valuable, because it went to the core of this study: all people, including software experts must admit, that no one, has any real and truthful knowledge of the meaning of artificial intelligence for the future mankind. I was surprised that the manager has not faced the AI-

subject at all. I recommend, that more connective research (AI+ESG) is needed soon.

5.1 Key groups that participate the AI developing

Artificial intelligence should be developed in sustainous way to serve our needs in making investment decisions, that would lengthen climate viability on earth. The one who can master the artificial intelligence, can cause a massive, destructive war, that is why we need ethics, democracy, societal decisions, research and development, and professionals who are willing to cooperate. I found that next strategic groups participate artificial investor developing (SGPAID) - they have most of the information to develop artificial investors. These groups of professional experts are or may be in key position and whose opinions we respect:

A) Scientific researchers
B) Social and political decision-makers
C) Investment & AI-developing professionals

Here is my estimation of what those three operators could do to create some workable structure of artificial investor strategy development, in case they respect the value of ecological capital in future investment context. The division of labor:

A: Scientific researchers:

The starting point is research of the significant issues like the economy and money circulation, and the climate, because it is the habitat, and it is the essential condition of life. To survive in the climate change, either the living population must change, or the climate change needs to be stopped, or steered in a more favorable direction by turning the direction of development, like reducing population growth and supply clean energy. Our entire environment (oceans and land areas) should be thoroughly cleaned. The main purpose of using artificial investor, could be lengthening the climate age (climage), because it doesn’t count (prioritize) the monetal profit (if it is not programmed to do so). Artificial investor can

count the wholeness and impartially forecast the climate viability because of its huge memory, and enormous capability to process current information together with historic information and future forecasts.

B: Social and political decision-makers

This part is for political leaders and decision-makers, as well as for voters. The difficulties of legislation are well known. Legislation affecting investment decisions is important in the coordination and implementation of digital services. By legislation we can influence the development of artificial intelligence - that it is benevolent and open. We also need free, open discussion with professionals, about artificial intelligence development and sustainability of environment, to avoid dangerous development. It’s like you improve your posture, like straighten up your body, to discuss openly and honestly about proven facts. To achieve implementation of improvements requires funding investments on research and development.

C: Investment & AI-developing professionals

These people are investors and engineers, who does the practical part of the work. They are in my focus to make survey of responsible investments, because they are the ones who discuss with capital managers (owners, etc.). Capital owners are decision-makers as well as data designers (programmers), who decide what an application like artificial investor can or can not do.

5.2 Future artificial investor - SWOT

I have described different factors to illuminate, how mankind could possibly lengthen the forecast of climate viability, because our future (and the future of value of investments and the need to make investments at all) depends on those factors a lot. We have created many artificial procedures (digitalization). We have put machines to work and we can teach machines to think.

Next step for a machine is to search information and make decisions, like investment decisions. Is there need for artificial investors? And what is an artificial investor? What does it? Who owns it? How much power it will have? Can it make better decisions than humans – could it make decisions, that impact the climate viability length? To open the phenomenon, I pick up some features of future artificial investor into next

SWOT analyses of future artificial investor:

Strengths:

- Ability to calculate the climate-related capacity
- Capability to analyze and make impartial assessments even though the amount of the informal material that must be evaluated and processed, is huge
- Impartiality, compared to humans
- Tireless thinking - lack of sleep does not affect
- Unlimited capacity for learning and applying – also employees can train artificial intelligence (Korhonen 2017)
- Utilizing Big Data – artificial intelligence is one tool that helps to serve customers better. It is an added value that brings personality to everyday life. Customers are known in companies, and service producers are well-versed in providing suitable services (Stenbäck 2017)

Weaknesses:

- Uncontrolled power – how to get control an uncontrollable power?
- Trust – how to program trust in a machine that can think?
- The lack of understanding of the entity of survival of living species
- Lack of ethical understanding
- Lack of thinking outside the box
- AI can't [easily be educated to] separate lies (false information) from truth or differentiate disinformation (deliberate lie to mislead) / misinformation (honest mistake) from reliable information, so it can be informationally vulnerable

- Physical limits (even if AI would have a “body”)
- Who will master the AI, can cause a destructive war

Opportunities:

- Capability to act creatively
- Capability to create a climate viability length forecast (CVLF)
- Capability to make exact and impartial, sustainable decisions
- Capability to consider all possible variables of viability (of climate, economy, ecology, social aspects, historical development, current situations, future forecast, carrying capacity) – and through them make optimal predictions and decisions
- Artificial intelligence can operate as Security Provider: More and more complex network architectures are a big challenge. You can boost cyber security with automation, analytics and artificial intelligence. The machine-learning network warns of attacks and enhances the ability to react on time. Business units require dynamically scalable data networks to innovate digital services and software (Arola 2017)
- Combining IoT with Artificial intelligence can be part of product development, e.g. collecting big data of suitable investment targets (=products) and participate to its development. Jochen Förster admits that technology is not a substitute for man, but [artificial intelligence] sensors save time and costs and promote the quality of the final product. Carlsberg's technology is still suitable for the food industry or drinking water analysis. (Karlberg 2017)
- Utilizing open interfaces = interfaces between information systems, which can also be used by others than just companies' own information systems. Open interfaces reflect the culture of sharing and transparency and affect to business models. Companies also utilize closed interfaces, meaning an interface that is open to a certain business customer by means of an agreement -> companies can access data from their partners for their own use, refine their information, extend their own digital products to other channels, or create entirely new products and services. Closed

interfaces strengthen the corporate ecosystem, that is, cooperation between companies. Like open interfaces, artificial intelligence is going to change world quickly and banks already utilize it today, that is called finance intelligence: “AI is part of our work, AI gives tips to sale service and it estimates what information is worth offering to certain customers based on current information that is available. AI can process huge masses of information and therefore it can provide advices because it can learn. In the future, for example, it suggests tips for saving – it identifies the client’s behaviour and can provide solutions for him / her. (Stenbäck 2017)

- Changes to banking: PSD2 (payment service directive) - in January 2018, banks' monopoly on customer accounts and payment service expires. Two of the three banks say they want to take advantage of the new PSD2 directive to change their strategic position (Vänskä 2017). At fall 2019 bankers must open account information and payout surfaces for free to third parties – in practice we are talking about open, free interfaces, Stenbäck estimates. That is, in near future you may be using Facebook or Google to pay your bills, making P2P transfers and analyse your spending, while still having your money safely placed in your current bank account – banks are obligated to provide these third-party providers access to customers’ accounts through open APIs (application program interface). This will enable third-parties to build financial services on top of banks’ data and infra-structure (Evry 2017)
- The new Investment Service Directive MiFID II, which will enter into force at the beginning of 2018, will improve the quality of investment services offered to consumers and investor protection. It extends the requirements of previous regulation and brings new responsibilities investment service providers (Op.media 2017)

Threats:

- Disobedience in the essential provisions
- Lack of cooperation

- Unreliability if there occurs an electrical disorder of power cut
- Unlimited capability to learn
- the servant becomes a thief: Crypto-currency miners (malicious software, the most common mining program, CoinHive, loads JavaScript into the machine, which then uses a large part of its CPU - Core Processing Unit (=prosessor) – power (Auto-tech 2017) "Crypto currency miners are a new, silent threat. Cyber criminals earn their revenue while reducing the capacity of victims' computers and networks", comments Check Point's Country Director Robert Lindqvist (Tivi2 2017)
- Low quality of data (Skssensors 2017)

At worst, AI can be evil terminator, a destroyer, like human is at his worst: warrior, greedy alien who let their own specie's population to recklessly grow and be spread itself uncontrolled. It can create such a legislation that doesn't support sustainable development and don't demand more efficient implications to stop climate change.

As its best, AI can be a friendly helper that appreciates clean nature, realizes the condition of climate and nature, fair, indomitable, understanding investor and investigator that finds solutions to the fundamental problems like uncontrolled population growth, climate warming, pollution and poverty.

It is not desirable that only unscrupulous greedy persons find themselves to financial advisers and portfolio managers. Those, who only care about the profit. That is not a good sign in Finland, where finance services are needed more and more. Most of current wealth belongs to elder generation. They should care wisely their money to be able to transfer the heritage for their offsprings. Many elderly people are not used to consume financial services, and there they need a reliable partner.

A simple aid is to add ethical contents to education and research. I was supriced, when I was googling Finnish publisments of topic "ethics of financing". I had only two matches.

The theme of ethics is not included in investment advisor's degree either. We must develop and implement a culture of action and procedure, that begins from the customer's needs, not from the broker's needs. People must be able to trust to the broker like they trust to a doctor or attorney.

Investors and investment companies can at best be a valued part of society. To grow up to be a prosperity promoter and dream makers, requires the perception of this time and the emergence of trust through genuine acts that generate the responsible image. That adds the trust for sustainabe future among people.

Though, all answers being speculation, about AI is making decisions in future investments, this research is valuable, because it shows how little we know about the issue (AI), that probably will affect totally to the future of mankind. The development of technology will also have an impact on investments in the future for practical reasons, such as money transfers, as people move on to use virtual currencies and block chain technology.

5.3 Recommendations

Because this kind of comparison of AI and responsible investment has not been done before, my specific recommendations are, that there should be allocated more resources, to find out, into what direction AI should be developed, how do we do the development, and how decision-makers (AI-developers and software engineers, directors and investors, politicians, lawgivers, etc.) should be educated, because they have the keys of future investments. Already today, behind the rapid changes in stock prices may be inflationary pressures as well as shares trading algorithms. When machines make a deal, and see something is wrong, they start to beat the sales and affects can be surprisingly steep. When algorithms gain power, the market is unpredictable and can turn dangerous. Within a day, movements can be wild when everyone reads the same signals without a clear picture of the factors affecting the economy.

It is difficult to produce one sentence answer to my main reseach question: “Could responsibility be the major competitive factor in future investment decision-making, that will base on information processed by algorithms?”, because there are so many variables that influence the result. My short answer is: yes, responsibility could be the major competitive factor, if the developers get enough educational competence to realize the purpose of responsible thinking. It can be major competitive factor in algorithmic decision-making if those who develop algorithms are capable to see the importance of nature diversity and the physical constraints of the Earth's carrying capacity.

Here is a summary of recommendations regarding the development of AI as a future responsible investment advisory tool:

1. AI-developers must have a holistic view of issues that affect to welfare of mankind, i.e. environmental, social and governmental issues, and good will to use it. Finland should invest both to cognitive sciences and economics, if we want to develop friendly artificial intelligence before others.
2. Responsibility (ESG) will be the major competitive factor in future investment decision-making, if AI-developers get right education and comprehension (ethics & ESG), and the developing is transparent and controlled. We need to teach ethics more clearly when educate people now and, in the future, especially the AI-developers, that they realize that responsibility is profitable and worth investing.
3. The legislation affecting the development of AI needs to be regularly updated.
4. The legislation affecting the protection of environment needs to be regularly updated.
5. Like weather forecasts, AI should be developed to use Big Data, to create reliable CVLF’s (climate viability length forecasts) as normal proceed every time, when it is analyzing information for investment purposes. CVLF -application should be statutory installed to every artificial investor -algorithm.

Because the measurements of responsibility are various, there are different academic researches that measure responsibility by profital view and society's point of view.

5.4 Appraisal of research process, validity and reliability

According to all the findings, we can not know what AI is going to be able to do in the future, because it seems to develop exponentially. It is now already almost "everywhere". All applications are not profitable or even very useful but seems like it is eternal. It can't be deactivated, it's here and stays here, to be developed further. I assume the answers of experts I sent questinnairies, very valuable and reliable, which gives strong validity and reliability for this research. Next level of studying this topic is, how ESG aspect has affected to development of AI, and what kind of applications there are available for helping consumers' investment decisions, to allow easy access to advices processed by AI, like AI comes an investment friend we can trust. For further studies, I hope there will be a scholarship or sponsors, who would become inspired to gain deeper research results.

An explanatory approach to analyze qualitative data, often uses statistical analysis and conclusions. An understanding approach usually uses qualitative analysis and conclusions. Most of the AI information for this thesis was gathered from current articles written by developers, who work for different organizations. Almost all self-respecting professionals and organizations maintain blogs in social media. I rely on the information when the writer is working on the industry he /she is writing about. Those blogs are their business cards – what an opportunity at the same time while interact with readers, to network, to present and to advertise your professionality.

As I evaluate if I did what I set out to do, I'm convinced that this research has answered the main research question. If I had done differently the theoretical basis - tighter and shorter - I would have ended up too tight

delimiting of the research subject, and that might have dropped some significant issues out of the processing and narrow the research approach and data acquisition, as well as the problem layout that I had set in the beginning.

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APPENDIX

Questions for interviewees

1. How would you estimate artificial intelligence could act in investments' decision-making at the present or after 10 years?
2. Do you believe that use of artificial intelligence increases in future?
3. How much do you know about development of artificial intelligence? Would you like to know more – is there enough information at the moment available?
4. Would you trust advices given by artificial intelligence?
5. If not, why not?
6. Do you know you are using AI already at your work? Does is matter to you or have you some opinion about it?
7. Could AI replace you at your work partly or completely?
8. Could AI lead this company or any company? If yes, how soon could that happen?
9. Do you know, if you have ever discussed with an AI? If you have, did you know it's a robot you discuss with? How did you know it?
10. Would you accept that AI would be your supervisor?
11. Would you accept that AI would be your subordinate / employee?
12. Do your clients know AI is going to make or already making decisions concerning investments and allocations of assets?
13. Would you tell your clients that AI is dealing with their affairs?
14. Do you know what is ESG?
15. Have you created an ESG strategy?
16. Can AI ever be responsible in investment decisions?
17. How would you describe AI's character? Does it have one?
18. What is good / bad in AI as an investor or decision maker?
19. Do you think AI could make better and more sustainable investments than humans?
20. Have you heard Ai does smart solutions in investment area?

21. How soon do you think that traditional banks will disappear, and money transactions will happen merely through other devices and applications, because of Revised Payment Service Directive PSD2? https://www.evry.com/en/news/articles/psd2-the-directive-that-will-change-banking-as-we-know-it/